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ABSTRACT

The conference recorded in this document covered a wide variety of themes and consisted of keynote addresses, research presentations, and workshops. The following keynote addresses are included: "Technician Training: A New Zealand Perspective" (Wood); and "The Provision of Information Services in Vocational Education: The Present and the Future" (Lee). The following research presentations are included: "Responding to Diversity: Learning Styles in Vocational Education" (Andrews); "The Future for Vocational and Technical Education" (Strong); "Alternative Approaches to Vocational Education--The Malaysian Experience" (Saleh); "Recent Initiatives in Staff Development in Vocational Education in Scotland" (Niven); and "Vocational Education: An International Perspective" (Hickey). The following workshop presentations are included: "Teaching Learning Skills as a Foundation for Technical Training" (Nelson); "Approaches to Instructional Strategies for an Information-Based Society" (Ross); "Socialization and Cognitive Process in the Appropriation of Technical-Scientific Knowledge and Practical Abilities in Vocational High School" (Hardy); "An Experimental Study of Incorporating Creative and Inventive Concepts into Vocational High School Curricula" (Wu); "Teaching and Learning in TAFE: Does TAFE Sell Its Students Short?" (Gove); "Vocational Qualification and Access to Higher Education" (Smithers); "Competency Tests: Their Role in Selection of Apprentice and Trainee Technical Officers in Australia" (Holdgate); "Development and Analysis of a Criterion-Referenced Test Item Bank" (Hinton); "Follow-up Studies of Vocational and Technical Education Graduates Using State Databases" (Strong); "Analysis of a Programme of Electromechanics of Automated Systems in Terms of Underlying Physical Concepts and Principles" (Gagnon); "Fast Track Apprenticeships and Multi-Skilling: Can We Have the Best of Both Worlds?" (Thomas); "Collecting Case Studies in TAFE Curriculum: Some Problems" (McBeath); "Teacher Motivation in Vocational Education: Causes and Consequences" (Nyberg); "Vocational Teacher Education: Research into Practice" (Prichard); "Evaluation of the In-Service Education Ordinance and Programs for Industrial Vocational Teachers in the Republic of China" (Shieh); "Apprentices Literacy Skills" (Sofo); "Regional Colleges: Resource Sharing between Vocational Education and Higher Education" (Atkinson); "Student Withdrawal from Part-Time Courses of Further Education" (Parkin); and "Improving the Quality of Vocational Education" (Jain). (CML)

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HOTEL ADELAIDE

MARCH 12-19, 1989

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VOLUME 1

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INTRODUCTION

Our conference consists of keynote addresses, research presentations and workshops. Keynote addresses will be presented at plenary sessions, but up to three research presentations or four workshops will be held concurrently. So that delegates will have the opportunity of attending all sessions of interest to them, all research presentations and most work shops will be given twice.

The conference has a number of principal themes, namely:

- women's issues in vocational education;
- learning styles in vocational education;
- performance assessment;
- economic changes and the technician workforce;
- education/industry links;
- vocational education, technology and society;
- vocational teacher education;
- improving opportunities for student retention and progress;
- vocational education across the world;
- curricula in vocational education;
- information services in vocational education.

While not every topic which is being discussed fits precisely into a principal theme, it has been possible to use the themes to structure our workshops. Thus delegates will find the material of particular interest to them collected together.

We have not included every keynote address, only those where the keynote speakers wished us to do so. However, all the keynote speeches will be published in the May 1989 edition of "The Australian Journal of TAFE Research and Development". We recommend that you subscribe for a copy or at least, urge your library to subscribe for one.

This set of conference papers is not a completely accurate reflection of the proceedings for two reasons.

. Not every paper reached us by the deadline. It is our intention to produce a supplementary issue to cover these papers.

. Some of our overseas delegates had difficulty in confirming their registrations. We decided to print their papers in the expectation that they could join us. If this has not proved possible, we have at least had the benefit of their thoughts.

KEYNOTE ADDRESSES

TECHNICIAN TRAINING: A NEW ZEALAND PERSPECTIVE

A paper invited for presentation at the TAFE International Conference
on Recent Research and Development in Vocational Education,
March 1989

Derek E Wood, Director, New Zealand Vocational Training Council

INTRODUCTION

Setting the Scene

The post-industrial society and the information society are terms which are becoming familiar as automation and computer systems play an increasingly important role in both developed and developing nations. In effect, they imply

- a steady decline of manual and unskilled jobs
- a steady rise of the servicing sector as the major employment area
- a growing demand for people with technical and professional skills

And the pace of change continues to increase. In New Zealand the Government's market driven policies have accelerated the decline of old industries and outmoded systems while new technologies are coming in at a faster and faster rate. Perhaps, most significantly, we are witnessing the change from mechanical and 'doing' skills to technical and 'understanding' skills. Hence the increasing importance of technician training. In presenting this paper I hope that the New Zealand experience may be of some assistance to others who are moving down the same path and, like us, have come rather late to a full appreciation of the importance of this occupational group.

New Zealand is a small country with a population of 3.3 million people which could be accommodated in Sydney. Australians may be tempted to suggest that many of them are there already! In this regard, it is perhaps pertinent to note the recent comments of the Australian Minister for Immigration (Ray, Oct 1988) who observed that "the youth and high mobility of the New Zealanders in the Australian workforce is a benefit to the economy" and that "they are twenty to twenty five percent more likely to have tertiary or trade qualifications than Australian citizens." And therein lies the rub, as these skills are a scare commodity that New Zealand can ill afford to lose. Compared with other OECD countries New Zealand already has only limited entry by school leavers to "middle group" occupations (Tetley, Whisker, Wood, 1986) and a low proportion of technicians in its workforce. International evidence suggests that the importance of adding value in a restructured economy exposed to market forces will increase the demand for such skilled workers. It is this concern that has prompted recent research by the Vocational Training Council.

Background

To understand the development of technician training in New Zealand one has first to understand something of the background to our economic and social development (Wood 1988a). Until Great Britain joined the European Economic Community in 1973 we were tied closely to the "mother country" by the bonds of tradition and trade. In return for duty free and unrestricted access to the United Kingdom market for most of our agricultural exports, Britain obtained an assured source of reasonably priced food - in peace and in war - and valuable preferences in the sale of manufactured goods. With this guaranteed market for its primary produce - comprising over 80% of its exports - New Zealand, by 1950, ranked third on the international index of wealth maintained by the Organisation for Economic Co-operation and Development (OECD) having, like Australia, "ridden to prosperity on the sheep's back."

But, despite the dominance of British manufactured goods and the dependence on primary industries, there was also a small but growing manufacturing sector. With the large scale deployment of men into the armed forces during the Second World War an acute shortage of skilled technical workers developed. Previously, when faced with skill shortages, New Zealand had simply encouraged further immigration - mainly from the British Isles, as you would expect. However, the harsh reality of war brought both the immediate and the future problem of trade and higher technological training into a new focus and led to the first long term planning for the introduction of comprehensive technical training.

Trade Training

Formal trade training came first. Although Acts of Parliament relating to apprentices date back to 1865, it was not until the passage of the Apprentices Act in 1948 that attendance at technical classes became compulsory for apprentices in most trades. At the same time a Trades Certification Board was established to conduct national examinations for apprentices. Although not compulsory these quickly became the standard trades qualifications with national and ultimately international recognition. In this regard New Zealand tradespeople enjoyed an advantage not shared by their Australian counterparts where, as late as 1974, the committee set up to advise on technical and further education reported that technical college awards had no universal recognition. (Kangan, 1974)

It was to be 35 years before the next major reform in trade training took place in New Zealand. Based on a detailed review of apprenticeship and recommendations for future policy by the Vocational Training Council a new Apprenticeship Act was passed in 1983. In addition to making the conditions relating to apprenticeship more flexible, by instituting joint and group apprenticeships and apprenticeships to industry, the Act opened the way for other major reforms. In particular, Government policy has forced a move away from "time served" towards "competencies acquired" as the basis for completion of apprenticeship contracts. Again the Vocational Training Council has played a major role through the development of training manuals and record books covering validated skills, identified initially through job and task analysis based on the DACUM approach. Adrienne Burleigh, the Council's Assistant Director (Training Development) will present a paper on this work later in the conference.

Technician Training

Given the infant state of our manufacturing industry at the end of World War II it is understandable that technician training developed more slowly. Indeed, as late as 1956, in an address to the Senate of the University of New Zealand, Dr C E Beeby, then Director of Education, said:

"New Zealand is backward in the provision of training for technicians and, indeed, in the very recognition of this most important category. We have, to be sure, occupations that would properly be classified under this heading, but the training we provide for them is often the sketchiest ..."

Not surprisingly, the first major development in technician training took place in the engineering industry where there was an emerging need for workers qualified to fill positions variously referred to as "engineers' assistants", "middle group engineers" or "technician engineers." The original five stage New Zealand Certificate in Engineering (NZCE), introduced in 1955 to meet the needs of the engineering industry, has now been the principal technician qualification in New Zealand for over 30 years - also with international recognition. Today New Zealand Certificates are available in a host of other engineering, building, science and commerce disciplines covering a much wider range of occupations, many of which might well have originally been regarded as outside the legitimate sphere of a "technician" qualification.

Technical Education

By definition, the training of technicians is dependent on an effective system of post compulsory education between the secondary school and the university - frequently termed technical education. In New Zealand technical day schools began to develop from the turn of the century - mainly in association with the evening classes that had sprung up for adults during the nineteenth century. Again it was the impetus of the war and the foresight of Beeby which brought the next major development. In the Commission on Apprenticeship and Technical Education set up in 1944 he saw the potential of technical colleges to provide the training necessary to meet the needs of increasing industrialisation and higher levels of skill. With the raising of the school leaving age to 15 imminent, Beeby saw the need to separate such training from existing technical schools.

Beginning with the establishment, in 1946, of the Technical Correspondence School (later to become the Institute) the foundations of the technical institute system were laid during the immediate post-war decade. With the appointment of Dr Bernard Lee as the first Director of Technical Education in 1956 progress was rapid. In the main centres new institutes emerged from the long established technical colleges and the senior technical divisions of secondary schools. The Central Institute of Technology was established as a national entity in 1960 and a network of technical institutes and community colleges spread progressively across the country so that today there is a polytechnic (as they are now called) in almost every major provincial town in New Zealand.

Summary

During the last 40 years New Zealand has developed its system of technical and further education in parallel with the emergence of trade and technician qualifications and authorities which ensure national acceptability and portability. Currently, as a result of a series of major reports culminating in the Report on Post Compulsory Education and Training (Hawke, 1988), the Government is introducing further major reforms designed "to secure effective funding and management systems while ensuring equity in both access and process." An essential feature of those changes will be the wholesale devolution of responsibility to local teaching institutions who will ultimately be required to purchase advisory services previously provided through central Government agencies. Within this overall scenario the Vocational Training Council has, for the past two years, been working with industry to identify the generic job competencies required and to make recommendations concerning an increased supply of technicians and improved on-job training.

In the remainder of this paper I propose:-

a) To consider developments in technician training in recent years
b) To discuss the VTC study and identify its outcomes
c) To identify and discuss the issues confronting technician training in New Zealand

RECENT DEVELOPMENTS IN TECHNICIAN TRAINING

The Starting Point

The scene for growth had been set by the start of the seventies. A Technicians Certification Authority (TCA) had been established in 1960 and the foundations of a national system of technical institutions had been laid. But there were many problems to be addressed (if not resolved) which were only beginning to be understood at this time.

In 1971 a national study conference on technician training, sponsored jointly by the Vocational Training Council and Massey University (Miller, 1971), considered the emerging needs of various sectors of the economy in a forum designed to identify problems and suggest solutions. From the outset the conference recognised the difficulty of defining "technicians" because the contexts in which they work are many and varied. However, it was generally agreed that there was a need for full consultation within an industry to determine the type of person needed, the type and level of training required and the likely future demand for those skills.

Another problem which was also identified in 1971 and has persisted throughout the intervening years was the need for a clearer definition of the industry based training needed in producing a qualified technician. Other problems identified which have been addressed progressively, if not systematically, included the need for wider publicity of educational and employment opportunities for technicians and the need for more "bridges" between technician and university qualifications.

Who Are The Technicians?

It is over 30 years since Popper (1952, p21) suggested that an attempt to define the term "technician" would not be profitable and "may lead to a good deal of hair splitting." Nonetheless, without the establishment of reasonable boundaries to "technician" activities, it is difficult, if not impossible, to develop appropriate systematic training. In seeking to establish these parameters in New Zealand, Offenberger (1979, p5) has made it clear that the traditional concept of a three-tier structure of technologists, technicians and tradespeople does not apply. He identified that, as long ago as 1970, less than half of the holders of New Zealand Certificates fitted within this structure and argued that technicians as a group of workers should be classified in looser and more general terms.

The segment of the workforce that this term covers is a rapidly changing one and it now includes a wide variety of occupations. **In general terms it encompasses people who would usually have qualifications different from the "professional" (or university) level but in advance of the trade (or equivalent) level. In terms of their activities they have been described by UNESCO, the British Technician Education Council (1980), and other authorities as "a broad band of personnel who have certain features in common: they have to exercise technical judgement, understand the principles underlying their work and the purpose of what they are doing and often supervise other staff".** For the sake of brevity I will use "technician" as an all inclusive term throughout this paper to cover this middle group of occupations.

Recognition

In spite of the recognition given to these "middle group" occupations by the establishment of a certification authority (TCA), they failed to gain the same support from industry that had been accorded to apprenticeship. In 1967 the Technician Training Act permitted the setting up of technician training councils to parallel the well-established national apprenticeship committees. However, there was little interest from industry, with the only developments being for building and dental technicians. The failure of industry to take this early opportunity to establish and oversee the on-job training it required for this emerging occupational group is understandable. But the consequences have meant a continuing difficulty in employers being able to identify both the importance to their enterprises and the training needs of this increasingly diverse group.

Given the diversity of technician occupations the task of developing suitable qualifications has also not been easy. The principal functions of the Technicians Certification Authority were to prescribe courses and syllabuses, to conduct examinations, and to issue certificates or diplomas to those who successfully completed the prescribed courses. In recognition of the expanding requirement for "middle group" qualifications the TCA was reconstituted in 1979 as the Authority for Advanced Vocational Awards (AAVA). A unique and extremely significant feature of the functions of the new Authority was its validating role. In recent years the establishment of the NZ Certificate as a benchmark has opened the way for the development and introduction of a number of related qualifications, some internally assessed in teachning institutions, which have helped to meet the diverse qualification requirements of the technician workforce.

In establishing its qualifications the Authority has sought to identify the essential difference between university education, with the objective of developing a student's thought processes, and technician education which aims to develop students to be able to apply knowledge to a variety of environments in order to solve problems. Thus AAVA has seen the challenge to produce programmes and qualifications that are not "lesser than" but rather "different from" university degrees. Because of their applied nature they are potentially of greater immediate value to employers in many work situations. The recent expansion of the Authority to include representatives of the Employers Federation and the Council of Trade Unions is an important recognition of the need to ensure that this objective is achieved and should assist in further enhancing the credibility of NZ Diplomas and Certificates in industry.

Industry-Based Training

In New Zealand all trades and many professions have always required a practical, work based component of formal training programmes. Similarly, since the establishment of the New Zealand Certificates in 1955 there has always been a requirement for work experience in technician training. Describing the position of AAVA on this the former Director, (Imrie 1987a), said:-

"For technician competency, vocational study and the passing of examinations should be complemented by work experience. It is the Authority's view that, for each student, suitable work experience provides the vital and individual context for effective study of vocational subjects and for the development of appropriate attitudes and understandings."

This is in marked contrast to the position described at the 1971 technician conference by R F Thomas (1971, p40). In speaking of the training of technicians in the NZ State Services (then the largest employer of this occupational group), and the frequent lack of systematic on-the-job training, he commented that:-

"A formal qualification, even a more or less practically based one like NZ Certificates, may be regarded as an indication of the level of work of which the holder is capable. Without adequate work-based training, trainees may never be in a position to return to their employer the benefits bestowed by their education. When this happens employers may be tempted to brand the Certificates as unncessarily theoretical and not worth the expense involved in allowing staff to study for them."

The intervening years saw some important developments concerning the vexed question of "suitable work experience" as the Authority sought to overcome the deficiencies highlighted by Thomas. The major initiative was the introduction, in 1984, of a work experience record book which provided a much more comprehensive description of the type of activities undertaken during the required three year period of work experience than was previously available. Growing pressure to increase access to training opportunities and difficulties in finding suitable work placements in the extremely tight labour market of the 1980s led AAVA to develop an alternative path to the NZ Certificate by the removal of the requirement for previous or concurrent work experience. As a result, since 1987, it has been possible for the required work experience to be gained after the formal training programme has finished, through the completion of a suitable work base project. However, only a small number of students have so far taken advantage of this relaxation of requirements.

More recently, the Government's concern at the lack of training placements available in industry has led to the establishment of two-year full-time pilot courses in polytechnics (covering the same field as the AAVA Certificates). This concept has proved extremely popular with the polytechnics, with the Authority having received some 30 submissions to establish such programmes in the last two years. But lack of adequate consultation with AAVA and the labour market partners has produced considerable tensions and unresolved industrial relations issues regarding the level of equivalence that will be recognised by the Authority and by industry - the ultimate arbiter in such matters. In an attempt to overcome some of these difficulties the Engineering Industry Training Board is currently endeavouring to produce a list of tasks to be performed on-the-job by those who graduate from the pilot courses in order to qualify for the new national certificate. The development of such full-time institution-based courses with the opportunity for greater academic depth but restricted opportunities for practical and industry-based training emphasises the importance of the validating role of AAVA in ensuring the acceptability to industry of the resultant qualifications.

Considerable progress has been made in the reform of apprenticeship and the move towards competency based training based on the task and job analysis work of the Vocational Training Council, but progress in the technician field has been much slower. Whereas the formal nature of apprenticeship contracts requires a commitment from employers to train, there is no such requirement in the training of technicians. However, where the DACUM approach to technician job and task analysis has been used as a basis for curriculum development, promising progress has been made. A growing number of major employers are now recognising the potential of this approach for the design of technician training.

Educational and Employment Opportunities

The 1971 Conference recognised the need for an improved vocational guidance service in schools to make young people more aware of career opportunities in the technician field. This process was assisted during the 1970's by the appointment of guidance counsellors in secondary schools and of liaison tutors in the technical institutes, with a major responsibility to work with guidance staff and students in secondary schools. During the eighties, as equity issues have become more prominent, additional tutors with specific responsibilities for women, Maoris and Pacific Island people have been appointed in many polytechnics with some quite marked success in encouraging these groups into technician occupations in which they have traditionally been under represented.

In 1978 the Vocational Guidance Service was transferred from the Department of Education to the Department of Labour to give it a sharper labour market focus. Now, 10 years later, it is likely that the wheel will turn full circle and that this service will become part of the proposed new Ministry of Education and Training. During the past 10 years the Vocational Training Council has contributed to vocational guidance in a significant way through the work of its specialist committees. In the early 1980's it published a series of personal profiles of women in 40 non-traditional occupations, many of which belong in the technician group as defined earlier in this paper. More recently the Council's careers kits on women in engineering, jobs in computing, and its video, The Last Entry, have been well received and popular in secondary schools.

But much remains to be done. In a recent research report (Tarrant, 1986), concern was expressed as to "whether we have the capability to generate the technological skills clearly needed to develop an economy which, under the realities of a changed world economy, can support both the material living standards to which we have become accustomed and the social and welfare goals we see as desirable." The report highlighted the failure, in the past decade, of the servicing sector - where most technicians are employed - to absorb the increase in the labour force while, at the same time, unemployment increased, job vacancies grew and overseas recruitment for specialist skills continued. It pointed to the need to ensure that an adequate hierarchy of technological skills is produced and to the importance of co-operation with Australia to heed the problems perceived as common to the Closer Economic Relations (CER) region.

Imrie, McCallion and Thomas (1985) have shown that, for a modest three percent growth of research and development - essential for our future economic growth and prosperity - the number of technicians qualifying in 1983 would have to increase by a factor of 2.5 by the year 2000. Given declining enrolments in the entry cohorts of our secondary schools and the current situation whereby the annual generation of technology-related qualifications represents only 9% of school leavers or, more starkly, only 0.4% of the total labour force, the cause for concern is clear and the need to promote career opportunities in the technician field is apparent. (Walsh 1986)

Building Bridges

Many modern writers stress the importance of upward mobility in the workforce and authors such as Peters and Waterman (1982) point to the success of firms who encourage the initiative and promote the career development of their staff. Some opportunities for such vertical mobility already exist in New Zealand. For instance, in certain circumstances, it is possible for an apprentice to commence part-time study for a NZ Certificate and continue trade and technician training concurrently. Provided the latter qualification is completed with high grades such a technician is eligible for direct entry to the second professional year of, for instance, an engineering degree course which can then be completed in two years of full time study instead of the usual four. The success rate of such students is well established and each year places are reserved for them in university schools of engineering. However, with the exception of engineering where the NZCE is highly valued in industry, it would be true to say that the linkages that have been established between the trades and technician levels are currently much better developed than those between technician and university qualifications. In the latter case the universities generally demonstrate a continuing reticence in other than their own environment.

The need for such flexibility has been recognised in Australia by the metal trades group of unions who have well developed proposals for major reform to the skill development and training arrangements applicable to their industry. These include the introduction of career paths to link operator to professional levels which will enable trades workers to progress to technician and ultimately to professional level by completing appropriate units of education and training (Sweet, 1987). While acknowledging the importance of such arrangements, the New Zealand Authority for Advanced Vocational Awards (AAVA) places a higher emphasis on developments in the area of technician training. To quote Imrie again (1984), "The principal objective of technical education is to equip technicians with a broad portable qualification which will provide an adequate foundation for change of occupation and the ability to learn from experience."

As a consequence of the recent reviews of secondary and tertiary education the Government has indicated an intention to replace the many present examining authorities with a National Educational Qualifications Authority with three sector boards dealing respectively with secondary, vocational and academic qualification and awards. The intention of those who have promoted this concept has been to improve the present provisions for "staircasing" or bridging between different but related qualifications. Hopefully, this initiative will ultimately make such progressions the normal feature of career development instead of the exceptions that they currently tend to be. Hopefully, also, this will have the effect of encouraging many who have acquired initial skills in practical areas to build a new theoretical understanding on to this foundation and so move into the important technician field of employment.

Summary

In a succinct summary of developments - or rather lack of them - in technician training during this period Imrie (1987b), in a paper presented to the Institution of Professional Engineers, stated "Current problems therefore, relate to years of neglect, lack of awareness and an absence of policy co-ordination by employers, government and the technical institute system, essential for development of the appropriate quantity and quality of technicians for the future."

It is against this background that the Vocational Training Council undertook its study of technician employment and training during 1987 and 1988.

THE VOCATIONAL TRAINING COUNCIL PROJECT

Objectives

The purpose of the project was to establish a foundation for future developments in technician training. To provide this, four principle objectives were identified.

It was first necessary to determine the present distribution of technicians according to sector of industry, geographical region and size of establishment to provide a baseline against which to compare future changes.

The second requirement was to obtain information about the range of activities carried out by technicians in their jobs and the skills and knowledge required.

A third and critical factor was the need to chart the mobility of technicians and to seek information about career paths as both of these factors have implications for training and retraining.

Finally, it was necessary to establish the pre-entry education and training background of technicians and to identify changing trends which could affect recruitment and training in the future.

Base Data

The five yearly New Zealand general census of population held in March 1986 provided appropriate base data for the study. Information on qualifications, employment sector, geographic location and other variables was obtained. But an immediate difficulty arose in respect to classification of the workforce in terms of occupations. The NZ Census uses the international standard which dates from just after World War II although minor revisions have been made since. This base proved most unsuitable as more than half the technician workforce appeared under just two of twelve categories: electrical/electronic and technical and other related workers. Since whole sectors of sunrise industries (e.g computers and information technology) were not in existence in 1946, the required discriminators could not be obtained under this classification. Although I believe there is a major revision now under way, international agreement on change takes some time.

Fortunately, another classification devised by AAVA was readily available. This addressed the emergence of technological and middle group occupations and fitted comfortably with the definition of technician adopted in this paper. Using this 18 category classification we targeted all employers of technicians in the total workforce - in excess of 1100 companies in all.

From the 40% of companies or organisations responding, the workforce analysed comprised 89,017 of whom 6802 were technicians. This percentage of technicians approximated that in the total labour force. During 1988, one third of the responding companies had follow up interviews to clarify issues identified.

I should add that the project took place against a massive restructuring of the NZ economy - the greatest upheaval since World War II. Responses from companies revealed the effects of this new hard nosed environment and sharpened the issues which surfaced.

I shall have insufficient time in this address to deal with individual employment sectors except in general terms. However, a workshop, led by the Council's Chief Advisory Officer, Bryan Whisker, is available during the Conference and he will be able to examine in more detail the individual sectors and their variations.

I wish to emphasise that this was an industry survey and the response called for was from employers. Although providers have the responsibility for a partnership in the delivery of training, the NZ Vocational Training Council has consistently held the view that the major responsibility for defining needs rests with industry and not with providers (Burleigh, 1984). While I am aware that providers do not always agree with this approach, I referred earlier to the problems that can arise when this principle is not followed.

Outcomes

In relation to distribution of technicians the survey confirmed the growing dominance of the Auckland region. There has been an accelerated transfer of the workforce to Auckland in recent years and technicians are no exception. The bulk of the manufacturing base, which has contracted sharply with Government free market policies and shed more than 20,000 jobs nationally in the past year, now centres on Auckland.

Although shortages of technicians had begun to show up in New Zealand around 1985 these have been concealed over the past three years through the redundancies that have followed the restructuring and contraction of the manufacturing sector. However, the survey showed that shortages were again beginning to emerge in Auckland and, by the end of 1988, there was evidence of shortages elsewhere. When the economy lifts further, severe shortages are likely to appear very quickly. Currently they are most apparent in the rapidly expanding and highly volatile data processing sector in which 24% of those employed are classed as technicians (comprising 8.5% of the total NZ technician workforce).

In international terms most companies in New Zealand are small, having less than 500 employees. The bulk of the private sector technician employees would find themselves working with quite small teams of individuals with qualifications similar to their own. In this situation it is not surprising that we found that technicians are required to undertake a wide range of activities.

From the current study the most important skills and knowledge required of a modern technician, as seen by employers, are **the ability to co-operate with people and work as a member of a team** (94% response as "very important") and **the ability to communicate information to others** (85% response as "very important"). Ability in **practical technical skill** rated a 72% response followed by **organising and planning skills** 70%. With only a 37% response, **supervision skills** ranked bottom of employers' requirements. One unexpected result was the emerging emphasis in some sectors of the economy on **legal expertise** - at least to the extent of a realisation of what not to do and when to seek legal assistance in a more complex commercial environment. Although a direct comparison is not possible, it is significant to note that Offenberger's technicians a decade earlier had required a different balance of skills (Offenberger, 1979) with greater emphasis on **diagnostic skill** and **design ability**.

Our study clearly revealed the strong mobility of the technician group within the workforce. This was not only from company to company, (60% of the workforce had worked for one employer for less than 5 years) but within the company as well. Mobility into positions of management or supervision is also rapid, where initial "technical" skills are required in an interpretive rather than an operational capacity. Our research indicated that, in the last 5 years, over half of the total technician workforce in the sample had moved in this way. The rapid move into management raises quite urgent questions as regards pre-entry training and certainly retraining requirements. It would appear that further information about the career paths of the technician workforce is necessary to provide for this.

The changing and expanding range of activities required of technicians, their high level of mobility and an understanding of their career paths are important factors to consider in relation to pre-entry training and trends concerning recruitment and future training needs. From our survey we found that 21% of the technician workforce have university qualifications and that half of the existing workforce of technicians had either trade qualifications on the one hand, or university qualifications on the other. This compares with only 43% who have entered employment with AAVA qualifications via the polytechnic system. The remainder have either no formal training or have overseas qualifications. But, irrespective of the source of initial institutional training, 75% of employers expressed approval both with the standard of new recruits and also with the balance of training between theory and practice.

Another related factor is the changing role of the State which has been a dominant force in the NZ training scene since World War II. This has been the case at every level, (trade, technician and professional) but, under present Government policy, the position has now changed. Our study revealed that over half of the total technician workforce had received their initial training within the state sector. But, with the conversion of former Government departments who were major training providers (such as, for instance, the Post Office, Electricity Department and the Ministry of Works) to State Owned Enterprises (SOEs) like Telecom, Electrocorp and Works Corporation, the scene is now very different. They are legal entities in their own right and, in the new user pays commercial environment in which they must operate, they own their own resources and raise funds in the market in the same way as private companies. The only major difference is that the Government is the sole shareholder - but it still expects a profit! Understandably, the practice of training surplus to requirements, in anticipation of heavy losses to the private sector, has stopped.

However, almost 80% of respondents were either not aware of this change of policy or were choosing to adopt a "wait and see" approach. In either case, failure to act now, by private sector employers who have traditionally recruited from the state sector, will have potentially serious consequences for the ongoing supply of technicians in an expanding economy as it responds to Government economic policy.

These changing trends which could affect recruitment and training in the future point to a number of issues that need attention. These will be the subject of the final section of this address.

THE ISSUES

From the work and research undertaken in New Zealand in the field of technician training in recent years a number of significant issues have emerged. These will need to be addressed if we are to be able to take full advantage of the anticipated economic upturn and to exploit the potential of new technology.

They relate in particular to:-

- the question of supply and demand;
- the variations in sector growth;
- the changing skills required of the technician workforce and the implications for pre-entry training;
- and the most appropriate delivery systems for ongoing training and retraining, both on and off the job.

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I will examine each of these in turn.

Supply and Demand

Through his detailed analysis of the employment and training of technicians Whisker (1989) has established a sound baseline covering 18 sectors of industry and commerce, from which changing future requirements can be identified. For this to be of real value, regular up-dating will be necessary. His work, and that of Imrie (op.cit.), emphasise the importance of collecting appropriate information if trends are to be correctly identified. Modern sampling techniques could be used to establish a number of "indicator" industries covering both the range and number of technicians employed. If co-ordinated nationally, the data base could be updated annually at minimal cost. In addition, under CER, it is imprtant to both Australia and to New Zealand to monitor the two-way movement of the skilled workforce across the Tasman. Currently, for instance, we have no reliable estimate of the number of skilled young New Zealanders who are assisting the growth of the Australian economy. A common labour market is rapidly becoming a reality and it will be important to establish common educational relationships if our common economic relationship is to prosper. The technician workforce will be a central and vital component in this exercise.

The information technology sector provides a classic example of the impossibility of developing appropriate training programmes in the absence of precise information. Prior to the work of Jackson (1983) and Wagner (1984) an outmoded occupational classification system prevented the accurate identification of skill shortages in this burgeoning employment sector. The data base established from their work provided the springboard for further developments. The next stage was the application, by Burleigh, of the cost and time effective DACUM process of job and task analysis to key occupations in this sector. This material was then used by a task force drawn from public and private sector industry and providers to develop and validate relevant and integrated on and off-job training tied to a nationally validated award. The secondment, by the Department of Education, of the task force convenor (an experienced head of department) as an 'energiser' quickly secured the support of the polytechnics and, to the amazement of those accustomed to the slow progress of traditional syllabus and curriculum reform, the new certificate in business computing was developed within 15 months - with an advanced certificate ready for introduction 12 months later at the start of 1989. The potential of this approach for application to other sectors in the technician field is now being realised.

In addition to a sound database such as this, another critical supply and demand factor is adequate two way communciation between industry (that has identified a need or a trend) and the potential workforce - especially those still at school who need clear signals as to likely employment prospects. In late 1988 the Royal New Zealand Air Force indicated that, despite visits to schools by its recruitment officers, it expected to recruit only half of its required 85 avionics technicians. At the same time, in the adult labour market, the Comalco aluminium smelter at Bluff reported that it would need to recruit technicians from overseas. When such major employers of technicians make these comments it is clear that, despite the initiatives described earlier in this paper, there is still a major communication dislocation to be resolved. The limited interest of senior secondary school students in technician type careers identified in

Project Fast (1988) was further confirmation of a serious communication gap.

Another essential prerequisite to ensure that supply and demand is in balance is the recognition by employers of their training responsibilities. As discussed earlier, the impact of the withdrawal by SOEs from the former Government department practice of additional training in anticipation of losses to the private sector has hardly been felt as yet. While, in the short term, it may be offset to some extent by the return of well qualified young New Zealanders from overseas, it is more likely to be accentuated by the lead time required for training. Furthermore, present policy directions, which discourage centralised interventions in favour of the operation of market forces, make it increasingly difficult to determine requirements on a national scale. For instance, under the former Ministry of Works, technician trainees were rotated through different divisions to gain work experience towards a NZ Certificate in Engineering. Approximately 100 per year studied the highway option of the AAVA course and entered the industry as roading technicians for the Ministry or for local government authorities. Under the new structures the responsibility for recruitment is no longer centralised. The National Roads Board, although not specifically charged with this responsibility and itself under threat of disestablishment, is the only national body in a position to fill the vacuum for the industry as a whole. With no active recruitment in 1988, and with local government restructuring in 1989 likely to concentrate on redeployment of present workers rather than new recruitment, there is a likelihood of a shortage of technicians in the 1990s unless urgent remedial action takes place.

Thus we face the double dilemma of needing to encourage young people to undertake training in career areas where there are currently no guarantees of employment knowing that, if we don't, we are likely to face serious short term skill shortages with the consequent inflationary pressure which this will create in the area of wage bargaining. Further clear evidence of this problem in practice was provided by the total lack of any enrolments for 1989 at the Central Institute of Technology for a new national certificate for industry (manufacturing) developed in consultation with an industry advisory group. Although there is an anticipated demand for such technicians two years hence, the current negative image of the manufacturing sector was no doubt the over-riding factor in student decision making.

The supply and demand picture is further complicated by demographic and economic factors. The ageing of the workforce is being accompanied by a corresponding decline in the population cohort that will be leaving the school system during the next two decades, although this may be offset, initially at least, by the increased retention rates in the upper secondary school. The Government's recently announced income support package for young people will also make tertiary study a more attractive option than the dole. In these circumstances, with indications that the polytechnics are likely to adopt a strong marketing approach to compete with the universities in the school leaver market, the supply of technicians could well increase. But this may be counterbalanced by an increasing tendency to employ graduates as technicians as shown in the Council's survey (Whisker 1989). It is against these conflicting trends and developments and continuing economic uncertainty that Government policy decisions, business investment decisions and the career choice decisions of our young people have to be made.

Variations in Sector Growth

In his best selling prediction of future developments, John Naisbitt (1982) said, "It's becoming clear that yesterday is over, and as the Third World prepares to take over the major industrial tasks, the developed countries must move on to the new enterprises." New Zealand is currently in what he describes as the "dual economy" phase, with both sunrise industries and sunset industries, and consequent confusion in analysing our economic situation. An application to our present situation of Naisbitt's hypothesis that "we lose all intelligence by averaging" supports the theory of rising and declining industries. Thus, although the employment statistics for September 1988 indicated that, on average, 9.6% of the national labour force was unemployed, the real picture was quite different. In areas such as greater Auckland and greater Wellington, where new information-based and service industries were emerging, unemployment (by district) ranged from 2.2% to 6.4%. But, in areas where freezing works and other primary processing industries had been closed or restructured (such as the Hawkes Bay), or the rural economy was stagnating (such as Northland), unemployment had reached as high as 13.7% and 16.4%.

Put in the starkest terms, as identified by Naisbitt, New Zealand has the option of becoming a developed country or of joing the Third World. To achieve the former, the issue of the training requirements of the emergent sunrise industries must be addressed as a matter of urgency. The consequences of not doing so will be a continued rise in unemployment as our inability to compete with the Third World nations in industrial tasks has already been shown since the removal of protection for local industries. An adequate supply of technicians for these new industries will be crucial for our success.

Pre-entry Training

The changing skill requirements and the mobility of technicians identified in the survey, their steady movement into management and the increasing "user friendliness" of new technology all combine to raise questions about the appropriateness for the future of present pre-entry training, despite apparent current employer satisfaction. The Hon Russell Marshall (1984) identified this problem in his address to the Economic Summit Conference when he stated:

> "The system of teritary education and training should have more of an anticipatory role by providing forms of education and training that will provide trained men and women who can match the job requirements of a changing economy. The emphasis in such education and training must necessarily be on the development of broad-based generalisable skills and abilities which can be built upon at a later date." (para 4)

It is significant for instance that one in five technicians has a university qualification and yet university courses are not primarily directed towards technician employment. However, the employment scene is a contributing factor in this. A young university graduate, say in engineering, will accept a position as a technician within a company in the hope that some time in the future there will the possibility of a move into professional engineering work. A job at the technician level looks good if it is the only job available. But given the large numbers who choose this course, further research is necessary on the appropriateness of present initial training.

Evidence of this problem surfaced in late 1988 when Waikato University found that science graduates were having difficulty in gaining employment that was commensurate with their qualifications. While, on the one hand, there would appear to be an oversupply of science graduates, employers of science technicians point out, on the other, that, since the reduced intake of Government trainees, there are few job seekers available with a NZ Certificate in Science. Moreover, they consider that science graduates are often not temperamentally suited to technician work as they not only have higher expectations and may be reluctant to stay but their skills do not match the job requirements and there is a concern as to whether they will perform satisfactorily.

It is also significant that supervision skills were not highly rated as requirements by employers and yet many technicians move into management. Should such skills and other broad management and instructional skills be required in pre-entry training in the future? How else, it could be asked, are technicians to acquire the human relations skills that are seen to be so important?

It now seems apparent that changing technology will involve forces moving towards deskilling on the one hand, and multiskilling on the other. Overseas research (Johnston, 1987) suggests that workforce flexibility requirements will almost certainly demand a higher base level of education - especially in fast growing occupations where there will be the greatest need of technicians. The boundary between technician and professional levels of qualifications is also likely to become more blurred as the concept of 'staircasing' or 'bridging' becomes more widely recognised and accepted. In these circumstances, initial training, up-skilling and retraining will all have a critical role to play in ensuring an ongoing provision of an adequately skilled technician workforce.

Ongoing Training and Retraining

While on the one hand the Government is currently promoting alternative training paths and experimenting with a new institution-based approach to pre-entry technician training, on the other the ongoing training and retraining of adults has assumed a new significance. In this regard, modular and open or distance learning may well appeal to management as a flexible tool to enable industry and commerce rapidly to update the skills of their present employees. New Zealand has a provider structure capable of meeting this challenge provided that a new era of co-operation develops between the national Technical Correspondence Institute, the Central Institute of Technology and the 22 regional polytechnics. In an earlier paper (1988b) I proposed a strategy that would allow New Zealand to take full advantage of overseas developments in the field of open and distance learning.

Just as much of the initial thrust of the Manpower Services Commission's Open Tech project was directed at the technician workforce in the United Kingdom so, too, is there an urgent need to undertake a similar initiative in New Zealand. Unless we are to resort to large scale immigration or to wait through the long lead time of initial training, **the only way open to us to close the skills gap is through upskilling the present adult workforce.** It will be too late for providers to plan for this when industry finally recognises the need. They must prepare NOW.

But it will be most unfortunate if they have to prepare on their own. The Vocational Training Council's experience with apprenticeship reform has shown the benefits of co-operation between industry and providers in a structured setting in which the role and responsibility of each is recognised. A similar partnership is essential if the urgent training needs of the technician workforce are to be identified and provided for as a foundation for the enlarged economy and renewed prosperity which is the aim of current Government policy.

Conclusion

From the outset the difficulty of identifying the technician workforce in a way that is easily understood by employers has been understood. And yet, in a deregulated economy, their very diversity may turn out to be a strength that needs to be recognised by employers. Adaptability, flexibility, mobility and good interpersonal and communication skills are likely to be key attributes in the workforce of the future. These are characteristics of technicians and training programmes will need to concentrate on developing them. Furthermore, they are traits that employers can appreciate - and ones on which they should be able to place a value.

But the urgency of the need does not yet appear to have been recognised either by Government or by employers. Nor, for that matter, have school leavers appreciated the career opportunities that technician training offers in a wide range of fields. There is obviously a major marketing and publicity task ahead of us. 1989 may well be a critical year for technician training in New Zealand. The effects of Government policy in economic restructuring should begin to be apparent in the creation of new jobs. A supportive and pro-active education and training environment will be essential.

But the impact of the devolution of educational administration envisaged by Hawke (1988) and Picot (1988), both in the schools and in the post-compulsory field, may well cause considerable initial confusion and uncertainty. Also, the time lag between the dismantling of present structures and the establishment of new ones seems likely to create a dangerous hiatus in which the ability of providers to respond to economic needs may be restricted. While the decentralisation of training delivery should make it more responsive to local needs, the requirement for centralised co-ordination of planning to meet national goals and to maintain portability of qualifications will remain. The proposed Ministry of Education and Training will need to take the central role in policy formation **in conjunction with industry and commerce as full partners** - a fact which Professor Hawke has apparently failed to recognise. In no area will this need for co-operation be more critical than in technician training. The need to achieve it may well be the most critical challenge that faces technician education and training in New Zealand in the immediate future.

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THE PROVISION OF INFORMATION SERVICES IN VOCATIONAL EDUCATION: THE PRESENT AND THE FUTURE

By

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Regardless of their level of economic and social development many countries are undergoing technological transformation. With the common objective of increasing productivity, incomes and ultimately human welfare, these technologies are being introduced in agriculture, manufacturing and service sectors. Some countries are implementing explicit technological policies to achieve the objective, but other countries are still in the stage of formulating policies.

The same is true in the field of vocational education and training. New technologies are increasingly being employed in training, administration, research and information services with the objectives of enhancing the quality of training and its cost-effectiveness. The pace of introducing technologies in vocational education is expected to accelerate further because the advent of advanced technology in industries has changed the labour market requirements.

The purposes of this paper are to review the current situation of information service in vocational education and training with a focus on the Asian and Pacific region; to overview the trends in information service; and to give suggestions on how to prepare for the future.

The Present Scene

In the Asian and Pacific region, APSDEP, since its inception in 1978, has been active in providing information on vocational training. It provides information to member countries in collaboration with ILO Headquarters in Geneva, ILO Turin Centre, Inter-African Centre for the Development of Vocational Training (CIADFOR), the Inter-American Research and Documentation Centre on Vocational Training (CINTERFOR), The European Centre for the Development of Vocational Training (CEDEFOP), and the Educational Resources Information Centre (ERIC). It also conducts seminars and workshops on information science in an effort to train and secure enough professionals in this field.

In 1986 APSDEP and 13 of its members established an information network called APSDIN (Asian and Pacific Skill Development Information Network). The national documentation centres of vocational training services in Australia, Burma, Fiji, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, Pakistan, the Philippines, Sri Lanka and Thailand were designated as APSDIN members. Later, eight new members joined APSDIN, bringing the total membership to 21. The new members are the documentation centres in China, the Asian Regional Programme for Labour Administration (ARPLA), the Asian Regional Team for Employment Promotion (ARTEP), the Central Instructional Media Institute (CIMI) in India, the Colombo Plan Staff College for Technician Education in Manila, The Korean Industrial Safety Corporation (KISCO), the ILO's Regional Office for Asia and the Pacific in Bangkok and the World Bank Resident Mission in Pakistan.

Currently APSDIN maintains six data bases and plans to build another six. The operational data bases are Bibliographic Information Service in Vocational Training (BISVOT), training materials data base (Union Catalogue), data base on experts in vocational training (Masters of Training), data base on programmes and courses offered by training institutions (Training Programmes), data base on various projects of vocational training and education (Training Projects) and data base on meeting up-dates in skill training (MUST).

The planned data bases are those on training equipment (EQUIHOTLINE), country profiles and vital statistics in vocational training (Training Statistics), legislation in vocational training (LEGIVOT), key words in vocational training (APSDEP Thesaurus), occupational titles and job descriptions (APSDEP Dictionary of Occupations), and on computer coursewares and interactive video programmes (APSDEP Coursewares).

The current and expected information products are APSDEP Dictionary of Occupations, APSDEP Thesaurus, BISVOT Series (Training Policy, Advanced Technology, Trainers Training, Training of Women, Vocational Guidance, Administration of Training, Programme Development, Training Facilities and Equipment, Training Research, and Evaluation of Training), Country Profiles, Directory of Training Institutions, Legislation in Vocational Training, Training Projects in the Asia and Pacific, Union Catalogue, Who's Who in Vocational Training and Meeting Updates in Skill Training. In addition, newsletters, documentation bulletins, library accession lists, publication lists and phamplets are published. All information products are issued in two forms: hard copy and floppy diskette.

In order to reduce printing costs and time APSDEP has introduced desktop publishing (DTP) techniques using micro-computers, laser printers, scanners and DTP softwares.

The selective dissemination of information (SDI) concept has also been introduced to serve the users of the APSDIN data base more effectively. However, on-line search is not possible, because national rates of progress in computerisation are highly unequal in this region.

New Trends

There are many titles of jobs in the field of information service. Among them are librarian, documentation officer, information specialist, information scientist, etc. There is no clearcut distribution between librarian and information officer. But, in ten years from now there will be more information related titles than those of the librarian. Likewise, the number of information centres will increase, while libraries will show a decreasing trend.

The conventional libraries have been concentrating their efforts in collecting books and documents. But information centres are limiting themselves to bibliographies rather than actual documents and focus more on collecting varied forms of information. While libraries are interested in text data, information centres are building text, numerical, voice and image data bases. By collecting more relevant, important and timely information on vocational education and training, information centres are in a position to serve not only decision makers and researchers but also teachers, students, parents and even vendors in the vocational education field.

While in conventional libraries cataloguing alone can serve the purpose relatively well, in information services centres, indexing and abstracting become essential tasks. Patterns of information storage and retrieval are changing, too. With the advent of mass storage devices such as hard disks, floppy diskettes, magnetic tapes, CD-ROMs and erasable optional disks, more information can be stored in a relatively small space. Also necessary information can be retrieved at any place and time, provided that communication facilities are available.

Libraries tend to react rather passively to information requests (retroactive service) because of their large collections of books and documents in fixed places and the inconvenience in transmitting information through the conventional delivery systems. In the case of information centres more active information dissemination is feasible mainly because of the portability of their information stocks and with the aid of computers and other communications systems. Therefore, more active interactions are expected among end users, and suppliers and producers of information. A good example of this trend is the selective dissemination of information (SDI). If we adopt expert systems then the just-in-time service and the interactive user services will be possible with little help from information specialists.

Issues and Suggestions

It was stated earlier in the paper that the number of libraries will decrease. But, how many libraries will remain in any particular time frame is a big question because it requires reallocation of resources and personnel. Therefore, it is necessary to examine the current situation and future demand for information carefully and make long-range plans for an orderly transition.

As the roles and functions of libraries are expected to change, it is necessary to redefine these roles more realistically in order to avoid any frustration or conflict with similar positions and roles in the field. The newly defined roles must be reflected in pre-service and in-service training programmes.

One of the great barriers to open access to information is the lack of standards in data processing and communications. In other words computer hardware, software and communication systems are not compatible enough to allow free access and easy exchange of information among different machines and operating systems. Therefore, it is necessary to make provisions for developing relevant standards for easy processing of and access to information.

It is expected that a large amount of vital information will be concentrated in a handful of persons or information centres. This phenomenon will no doubt cause some misuse and undue manipulation of information which might threaten the existing social order and justice. Therefore, counter-mechanisms to prevent the exploitation and distortion of information for personal gains should be devised in advance.

Undoubtedly, new technologies will be extensively used in the field of information service. On first thought, it might be encouraged under the name of efficiency and cost saving. But on second thought it might create great role conflicts. For example, a well equipped learning resources centre might serve the same functions as of a school. An information officer who can manage all the resources can perform the role of the future teacher as well. This puzzling situation will be experienced in administration and research fields too. To encourage it or not should be determined after a careful research and discussion.

RESEARCH PRESENTATIONS

ADELAIDE ROOMS

2.00 pm

except Wednesday 11.00am

MONDAY MARCH 13.

Room 1

Associate Professor David B. Andrews. Associate Professor of Psychology, Keene State College, New Hampshire USA. *Responding to Diversity: Learning styles in vocational education.*

Room 2

Professor Merle E. Strong. Vocational Studies Centre, University of Wisconsin - Madison, USA. *The Future for Vocational and Technical Education.*

Room 3

Dato Haji Ahmad bin Haji Salleh. Director, Technical and Vocational Division, Ministry of Education, Malaysia. *Alternative Approaches to Vocational Education - The Malaysian Experience.*

TUESDAY MARCH 14.

Room 1

Mr. Peter Thomson. Deputy Director, TAFE National Centre for Research and Development. *The School of Hard Knocks Revisited: The assessment of practical skills and experience.*

Room 2

Mr. Stuart Niven. Director, School of Further Education, Jordanhill College, Scotland. *Recent Initiatives in Staff Development for Vocational Education in Scotland.*

Room 3

Dr. Delina R. Hickey. Interim Dean of Professional Studies, Keene State College, New Hampshire USA. *Vocational Education: An international perspective.*

WEDNESDAY MARCH 15.

Room 1

Associate Professor David B. Andrews. Associate Professor of Psychology, Keene State College, New Hampshire USA. *Responding to Diversity: Learning styles in vocational education.*

Room 2

Mr. Henry G. Macintosh. TVEI Unit, West Sussex Institute of Higher Education, United Kingdom. *Technical and vocational Education Initiative Unit and its Impact on Curriculum Development.*

Room 3

Dr. Delina R. Hickey. Interim Dean of Professional Studies, Keene State College, New Hampshire USA. *Vocational Education: An international perspective.*

THURSDAY MARCH 16.

Room 1

Mr. Peter Thomson. Deputy Director, TAFE National Centre for Research and Development. *Assessing Experience.*

Room 2

Professor Merle E. Strong. Vocational Studies Centre, University of Wisconsin - Madison, USA. *The Future for Vocational and Technical Education.*

FRIDAY MARCH 17.

Room 1

Mr. Stuart Niven. Director, School of Further Education, Jordanhill College, Scotland. *Recent Initiatives in Staff Development for Vocational Education in Scotland.*

Room 2

Mr. Henry G. Macintosh. TVEI Unit, West Sussex Institute of Higher Education, United Kingdom. *Technical and Vocational Education Initiative Unit and its Impact on Curriculum Development.*

Room 3

Dato Haji Ahmad bin Haji Salleh. Director, Technical and Vocational Division, Ministry of Education, Malaysia. *Alternative Approaches to Vocational Education - The Malaysian Experience.*

RESPONDING TO DIVERSITY:
LEARNING STYLES IN VOCATIONAL EDUCATION

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Vocational educators often enjoy an enviable clarity of task: teach students specific identified skills, for specific applications. Behind the advantage of this clarity lies a vexing double enigma. One the one hand, a high percentage of the students will not be doing what they are trained to do for very long - new careers and technologies emerge rapidly. Thus, in addition to training specific job skills, one must also focus on "transferable skills," in particular improved ability to learn in the future. On the other hand, no matter how good assessment and placement systems may be, any group of students will have varied general ability, motivation, and preferred modes of learning. For these reasons, vocational educators have been leaders in the application of learning styles to instruction and in the teaching of generalizable learning skills.

Sensitivity to learning style principles is even more important for vocational educators in the international arena. Much current teaching is for jobs or markets, and using curricula and materials, developed by individuals from other cultures or with different learning styles than those using them. Students may come with varied cultural backgrounds, and may well go to work in others. To further challenge the vocational educator, the teacher is often someone who was trained in an environment similar to where the jobs and the curricula originated - or has a learning style more compatible with that than with the students. Thus, providing teachers with methods for understanding the learning preferences of their students, and with the curricula and materials to respond successfully to them is critical for successful instruction.

This paper will look at an approach to these issues based on current research on learning styles, cognitive psychology, individual differences in brain function, and the application of this information to the general improvement of vocational education internationally.

Learning Styles - A Brief History

Teachers have long recognized "stylistic" differences in their student's learning; but, systematic interest in preferred mode of learning has a very recent and difficult history. Prior to the 20th century only a very few theorists or researchers (e.g. Sir Francis Galton) even considered the issue. With the advent of intelligence testing and behaviorism, both researchers, and teachers focused on identification of individual potential (intelligence) and the development of **the** optimal approach to teaching (**the** curriculum). In the 1920s and 30s there was some spotty interest in Audials (those who preferred learning through hearing) and Visuals (those who learned better through seeing); but, this faded from the mainstream quickly. In the 1960s Herman Witkin proposed that some individual's perception was biased by contextual location (field dependent); while others could more easily perceive items independent of their contextual field (field independent) (Witkin, et al, 1962). Quickly, researchers identified a substantial number of other dimensions of "psychological differentiation," soon to be known as cognitive style. Educators began to identify other dimensions of individual differences in factors contributing to success in learning (Kirby, 1979). Most recently interest in brain organization (left and right hemisphere differences) has catalyzed an explosion of interest in stylistic learning differences (NASSP, 1982). A recent count by the author yielded over 90 (almost certainly not all) different dimensions of learning style. Amid current concern for improvement of education and confusion as to the appropriate model(s) of learning style, the field has become alive with a myriad of entrepreneurs ready to provide their assessment instruments or curriculum. For the practitioner the situation is perplexing.

The Brain and Learning Styles

Recently there has been a remarkable interest in left and right hemisphere brain function and what it suggests about learning style (Languis, 1984). While the evidence suggests that the differences between the two hemispheres of the brain is very small, and all tasks are done with both hemispheres, the power of this brain-based metaphor has proved quite compelling.

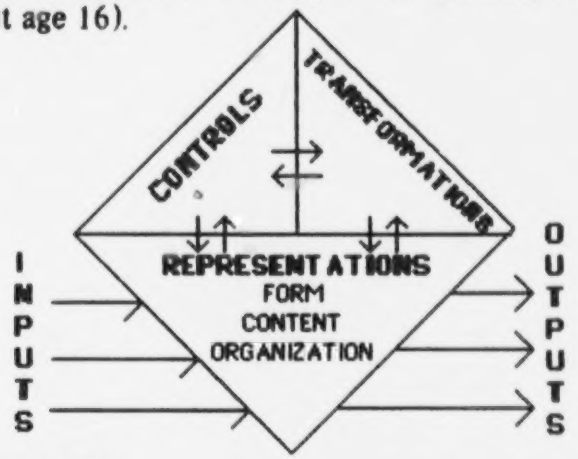
I have been working for 4 years with the mapping of brain electrical activity of individuals while they are thinking, learning, reading, writing, etc. This work allows visualization of the brain function of individuals while they are engaged in a learning task. The data have produced clear patterns of differentiated brain function of individuals with putative learning style differences. However, the most dramatic variation is seen in the brain activity of the same individual approaching the same learning task using different learning strategies (demonstrations will be provided). Furthermore, individuals taught various strategies for learning are able to modify their learning approach, their brain activity and their learning success (Andrews, 1986). These results (largely confirming the work of Luria, 1973) have led to the development of a model of brain function in learning that acknowledges and identifies individual differences in learning style, but places the emphasis on those areas where learners can become active in regulating their own learning.

Learning Model

As the model below indicates, we must recognize individual differences in preferred modes of **input** (including attention) and **output**. If the method of getting information into the learner or in finding out what the learner has learned uses a "weak" channel the results may not be representative of actual learning or learning ability (examples will be provided). The knowledge acquired by an individual takes the form of **representations**. These can be of different types, will have different content (based on the individual's past experience) and have unique organization (e.g. if organization is more holistic or field dependent or simultaneous, we might say it was of the right hemisphere type; if more discrete, logical or sequential, we might say it was of the left hemisphere type). The type of representations a individual has will determine what will be motivating, attended to, and retained.

All learning is subject to **transformations**. When we see a teacher do something and repeat it, we have a visual experience transformed into a program for muscle movements that will produce the same result. When we read, we convert visual symbols into auditory codes which we convert into representational meaning. Successful learners continually transform what they are given into the form that is best related to their mode of representation - e.g. I convert most things into visual imagery/representations, regardless of the original form of the input. Less successful learners do not transform, and thus, tend to not retain well.

Each of us has **controls** by which we regulate our learning. These as learning strategies; however, the most important part of controls is the setting of goals and the monitoring of our progress relative to these goals. This is critically dependent on the operation of the frontal lobes of the brain, the part of the brain that is unique in the human, and the part that develops its mature function the latest (about age 16).



Application to Instruction

Any attempt to improve student learning must focus not just on matching the learning activities to the particular input, output and representation preferences of the learners, but make the learners active in the control and transformation of their learning activities. Successful learning is always an active effort on the part of the learner. The most successful learners are those who best understand their learning strengths and weaknesses, thus knowing the most effective types of controls and transformations for them to use in a learning task. This knowledge (metacognitive knowledge) enables the most effective generalization of learning skills to new situations.

Assessment

A critical questions in the application of this knowledge is how to assess individual learning style differences. I suggest three general principles:

1. Never try to make a universal assessment. The critical assessment is of those learners present, in the current learning context. It is not clear that any

specific set of dimensions of learning style is present in all situations or critical to all tasks. The only critical condition for learning is learner activity!

2. It is more important for the learner to learn about his or her learning strengths and learning options than it is for the instructor to make a correct assessment. Students need to engage in group goal-oriented tasks where they can see the different ways that others approach the task. It is most helpful to frequently ask people "how did you do that?", "why did you do it that way?", "how else could you have done it?", "which way would work best?", "why?"

3. Use informal questions and observation (rather than formal assessment) to get a sense of learner preferences (examples will be given).

What to do with the results

Success in applying learning styles information depends on accurate identification of learning goals, the approaches of the learners and the teacher, and the decision about how to apply this information. The most common approach to learning styles is to match teacher and learner style. While that will produce rapid initial learning, there are three reasons that it may not be the best approach. First, there will be nothing to produce change in the learner's approach, strengthen weaknesses, or teach functioning in difficult situations (matters of considerable cross-cultural significance). Second, teaching is difficult in modes other than one's preferred mode. Third, any group will contain a variety of learning preferences; matching styles becomes very difficult, at best.

The following principles are recommended:

1. Focus on the attainment of goals - not the methods are used to get to the goals (unless a specific method is necessary (then it is a goal!)). Beware - what seem like necessary methods may be our habits or preferred modes.
2. Give students opportunities to view the goals and make suggestions for how to get there. Have small groups share ideas and come up with proposals.
3. Vary the teaching approach (suggestions will be provided).
4. Have the students teach each other as much as is practical.
5. Build into all learning activities opportunities for students to plan procedures, and to evaluate critically what has been accomplished.
6. Know your students - their prior knowledge, their social and personal preferences, and their goals. Teachers must "learn the students" as well as teach the content.
7. Start where the students are; but, challenge them.
8. Make suggestions for operations that the students can "do in their head" - e.g. alternative transformations, organizations, controls. Focus on the students having difficulty learning.
9. Seek guidance from students in the teaching of future students.

Conclusion

Effective instruction requires semsitivity to individual differences in modes of learning. In vocational education in the international arena this is particularly critical, given the cultural variation, mobility, technological innovations and the need for more generalizable vocational training. A better understanding of brain function, currently becoming available through new technologies, is an invaluable aid to improved understanding of individual differences in learning style. These results, combined with further research on learning style will enable us to develop better modes of vocational instruction.

Additional Information Available

Detailed printed information is available from the author on the following:

1. The learning model presented here
2. Intervention strategies to improve learning, based on the model
3. Guidelines for learning style sensitive instruction
    a. developmental issues - personal and cultural
    b. multisensory approaches
    c. interactive teaching models
    d. feedback from students
    e. change of learning style
    f. low cost/low training modes of teacher training and curriculum development
4. A model of brain function identifying individual difference in learning
5. A model for informal assessment of learning style preferences
7. An annotated bibliography of learning style assessment instruments
8. A learning styles bibliography
9. A "master list" of identified or proposed learning style dimensions.

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THE FUTURE FOR VOCATIONAL AND TECHNICAL EDUCATION

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The welfare of any nation and the quality of life of its citizens depends upon the ability to plan for the future and to provide a workforce that is not only effective and efficient, but one that can compete internationally.

The purposes of this presentation are twofold, namely, to share with you a process that was used in Wisconsin to address the future needs of the work force and to highlight some of the issues and findings for the development of vocational and technical education, particularly for Wisconsin. The process that was used has implications for any state, province, or nation because it can be replicated. The findings should also be of value, at least, as a starting point in your thinking about the work force needs in your state or nation. As one considers work force needs across the world, there are obviously many differences. However, as economies are becoming more regional and worldwide in nature, our needs are similar in many dimensions.

Rational and Activity Plan

As a part of the Wisconsin Vocational, Technical and Adult Education System's 75th anniversary, the State Board enlisted the Vocational Studies Center to implement "The Future of Working Wisconsin" project. In proposing an approach, it was believed that a strategy should be developed that would cause us to take not only a future view but a somewhat global view as well. While vocational and technical educators have always been conditioned to look at immediate manpower and training needs in their communities, it seemed appropriate that we cause our leadership to take a much broader look based on the premise that Wisconsin will be greatly affected not only with what will take place in the nation–but in the world as well.

As a part of the effort, the Governor's assistance was solicited and "The Governor's Conference on the Future of Working Wisconsin" was held in February of 1987. More than 800 national, state, and local leaders from business, industry, agriculture, government, labor and education came together to consider the needs of the work force in the 21st century.

Several strategies were used that have contributed to not only the success of the conference itself, but to the continuing impact on training in Wisconsin. A planning committee was organized consisting of educaton, business, labor, agriculture, and government representatives. They helped identify the large topical areas to be addressed which will be shared later. Their assistance was utilized throughout the planning, implementation, and follow-up of the conference.

An early strategy agreed upon to address the topics was to secure the best resource person in the nation on each of the major topics in order that they could provide papers and speak from a national or international perspective. These speakers were then followed by state leaders who could react or relate the content to Wisconsin. Only a limited number of educators were used as speakers as the objective of the conference was to look at the "big picture" of work force needs with implementation strategies and plans for education and training to be the next step.

Each of the 16 vocational, technical and adult education districts in Wisconsin identified teams of participants to attend the conference. Staff, board members, business, agricultural, and labor leaders were included. It was the responsibility of this team to plan further activities for the development of their strategic plan for vocational and technical education in their districts.

It is, of course, difficult to measure in specific terms, the impact of the overall activity, but the strategy of the activity seemed to be successful. The conference itself received a fine evaluation. There is evidence that districts have continued to hold discussions on the report and that it has made an impact on their annual strategic planning exercise. The report consisting of nearly 500 pages has served as an excellent resource document.

Workforce Considerations

As a framework for considering the needs of the work force, the following main topics were used:

- Demographics;
- Economics;
- Manufacturing and industrial development;
- Agriculture, agribusiness, and biotechnology;
- Health care delivery;
- Service industries;
- Communications technology;
- Aerospace technology;
- Energy and natural resources;
- Quality and worker productivity;
- Opportunities for working Wisconsin; and
- The future of education and training.

It will not be possible to address each of these main topics with any degree of comprehensiveness but only to highlight a number of points that may be of interest to you and that are exemplary of the final report's content that is available.

Demographics and Other Workforce Considerations

Let me highlight just a few demographics, some that may have implications to all of us no matter where we live in the world, others that are more specific for the U.S.

The world population growth is projected to slow for the remainder of this century; most of the growth is expected in the less developed countries. For those of us in developed countries, population increases are not expected to be a problem, but taking the global view, the story is different.

Brown, (1988) in a recent issue of World Watch, addressed the problem of populaton growth in lesser developed countries and its contributions to the expansion of poverty.

> India, with nearly 800 million people today, could add another billion before its growth comes to a halt late in the next century. The population of Wisconsin-sized Bangladesh is expected to go from 104 million to 342 million before leveling off.
>
> In Africa, World Bank demographics foresee Ethiopia's population of 46 million swelling to 205 million. (p.2)

There has been a wide divergence between the U.S. employment growth and the employment growth in other industrialized countries. The baby boom generation has a different timing in each country: Canada and the U.S. had the baby boom in early 1970s, Western Europe in early 1980's; and Japan and Australia in the late 1980's.

The population growth in the U.S. is projected to slow. Net migration is expected to be 20 percent of our population growth. The share of our population over age 70 will continue to increase with a particularly sharp increase in the over 80 population. This later fact is no doubt representative of the entire developed world.

Over the past five years, nearly 90 percent of our labor force growth has been among women, blacks and Hispanics. The labor force participation rate for women ages 25 to 44 is projected to rise from 70 percent in 1984 to 80 percent by 1995.

Ninety percent of the job growth is projected to be among the service producing industries in the economy. Manufacturing employment is projected to grow modestly. A high percentage of projected job growth will be found among highly skilled professional, technical, and managerial jobs.

Relative lack of credentials for a wide range of U.S. jobs contributed to labor market dynamics; occupational mobility is high among U.S. workers, particularly among the young and those in lower skilled jobs.

Cetron (Cetron, Rocha, & Luckins, 1988) in speaking of the rise of knowledge industries indicated that

> about half of the service workers will be involved in collecting, analyzing, synthesizing, structuring, storing, or retrieving information as a basis of knowledge by the year 2000. Half of these people will be working at home.

In terms of manufacturing industry, it is no secret that the U.S. is in a period of stagnation. Jasinowski (1987), Executive Vice President and Chief Economist for the National Association of Manufacturers, taking the global view, supported the following to strengthen the U.S. manufacturing economy:

- There should be a national commitment to trade competitiveness.
- There should be an increased recognition of manufacturing's importance to economnic health.
- The fiscal deficit should be reduced.
- Trade policies should be strengthened to stimulate exports.
- The exchange rate should be lowered.
- Improvements in corporate ability to compete are essential.
- There should be further regulatory reform to reduce governmentally-mandated costs on the private sector.
- Policies should be instituted to raise investment and savings.
- Greater support should be given to technological innovation.
- A more stable financial environment should be created.
- Investments in education and retraining should be made.
- The central criterion for major policy decisions should be their impact on trade competitiveness and growth. (p. 100)

Berman (1987) suggested that Wisconsin must target industries that complement the advantages the state has to offer business. Wisconsin's challenge becomes one of capitalizing upon changes by:

- applying new technologies to improve productivity;
- applying new technologies to develop new products;
- finding niches for state's businesses in global markets; and
- providing an infrastructure conducive to business growth. (p. 106)

Berman further outlined five key factors necessary to creating a competitive advantage for Wisconsin. They are:

- Provide access to technology. Continuing to nurture and develop facilities in the University of Wisconsin and vocational education systems will do this.
- Providing a skilled and flexible work force.
- Building and maintaining adequate infrastructure.
- Acquiring capital for business investments.
- Developing a positive entrepreneurial climate (p. 107)

Kinney of Allen-Bradley Company (1987) suggested that with world competition the quality of management may be the most important factor affecting the future health of Wisconsin's industrial economy.

> One of the most important attributes to quality management is greater responsiveness to changing market needs. Essential to quality management is:

- Greater attention to quality of product and people;
- Greater concern for productivity and cost control;
- Greater emphasis on long-term performance; and emphasis on innovation and risk-taking (p. 113).

Wenzel (1987) suggested that:

> We stand on the threshold of a burgeoning health care system, one that has already changed more in the past 20 years than it had since the turn of the century. The changes we will see in the next five years are so mind boggling that we will find ourselves in a "whitewater" period in the evolution of health care (p. 161).

Wenzel, in supporting his promise about change in health care, set forth the following points:

- For 1987, it is projected that $512 billion will be spent for health care as compared to $42 billion in 1965.

- For this same period, cost rose from 5.9 to 11.0 percent of gross national product.

- Regardless of how health care is supported, choices will have to be made, however, public policy will increasingly demand "health care as a right."

- The surface has only been scratched in the development of medical technology.

- Future technology will deal principally with genetic engineering and the installation of spare parts.

- If America's good health is to be the number one priority, we must continue and intensify efforts to insure the goal is met.

Louis Branford (1987), president of the Public Service Satellite Consortium in Washington, D.C., spoke of the great strides that have been made in space technology since Sputnik was launched in 1987. While the U.S. continues to maintain a prominent role in space technology, space related research and development is being conducted in many parts of the world.

Branford suggested that we beamed with pride 30 years ago as we launched an object the size of a grapefruit into orbit but today we think nothing of launching satellites 39 feet tall with solar panels extending 50 feet across.

Satallite capacity has increased dramatically. INTEL SAT VI has the capacity for 120,000 simultaneous two-way telephone circuits, plus three television channels.

Fiber obtics is another breakthrough in telecommunications technology. A single finger thick strand of optical cable could carry every telephone conversation held on an average business day in the U.S.

Telecommunication technology is not only transforming the way we work, but the way we learn. The implications for the work force and for education and training are very great.

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ALTERNATIVE APPROACHES TO VOCATIONAL EDUCATION - THE MALAYSIAN EXPERIENCE

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Introduction

As we approach the end of this decade, vocational educators throughout the world must surely be confronted with a good number of questions and issues which do not seem to have clear-cut solutions. What will vocational education be like in the 1990's and beyond? With rapid technological changes never before imaginable, will there be significant changes in the structure, contents and directions of vocational education systems in the coming decade? Should preparation for specific available jobs remain the major basis for planning vocational education programmes? Are our vocational education programmes responsive enough to the needs of students, community and employers? Is vocational education held in high esteem by students, parents and the community or is it considered good only for "second raters"? Should vocational education be terminal or should there be provisions for upward mobility in the system?

Coming from a developing country like Malaysia where vocational education is a relatively new phenomenon when compared to general education, these questions must seem especially critical as the nation's desire to join the ranks of the world's industrialised elite group can possibly be realised only with the availability of a highly trained workforce. High national expectations, therefore, can place the vocational education system under a tremendous pressure and great accountability to "deliver the goods" as it strives for further improvement in both quantitative and qualitative terms.

I certainly do not profess to know all the answers. What I will attempt to do, however, in this short paper is to highlight some of our experiences in this interesting field of what is termed "vocational education" with the hope that, somewhere along the line, some of us may identify ourselves with the problems and issues being raised and mutually benefit from the ensuing discussions.

There definitely are no easy solutions to the issues confronting vocational educators. Quite often we are faced with programme objectives which are in conflict with one another. For instance, making a programme too job specific will often be at the expense of provisions for further education and vice versa. However recent developments in vocational education in Malaysia have shown that objectives and issues have to be clearly and explicitly addressed in order to make our programmes more effective and "marketable".

The Position of Vocational Education

In many developing countries, vocational education has somehow been relegated to the bottom of the educational hierarchy. This is in spite of the fact that the rapid development of science and technology in our present times requires education to prepare students to face technological changes and to be relevant to the world of work. Vocational education has a large and major role to play, especially if technology is to be applied to the problems of development, in terms of skilled and trained manpower to carry out the task of economic development.

Significance of Vocational Education

In the broadest sense, and at the risk of over-generalising, vocational education can be defined as "any kind of training that relates to job and job skills". Available literature has given varying definitions of vocational education in accordance with varying levels of national industrial development and requirements.

Vocational education, according to UNESCO, should be "an integral part of an overall system of education and as such due consideration should be given to its cultural content. It should be more than training an individual for a given occupation by providing the persons concerned with the necessary skills and creditable knowledge, which should also, in conjunction with general education, provide for the development of personality and character, and foster the capacity for understanding, judgement, self-expression and adaptation to varying environment".

The role and importance of vocational education, especially in an age of accelerated development of science, technology and industrialisation, cannot be over-emphasised, more so for developing countries. Many countries which are relatively "young" in history and management of vocational education have been "struggling" with its various definitions, role, structure and position in relation to the national general education system. We in Malaysia have not been spared from this predicament. Through various trials and experimentations in the planning and implementation of vocational education in Malaysia, we certainly hope that we have managed to correct some of the misgivings about vocational education and provided it with some amount of self-respect in its present position in the country's education heirarchy.

Vocational education is necessary in order to:
(a) raise the general technological literacy of the people to face technological changes
(b) provide an infra-structure and a technological base for the supply of skilled manpower

(c) prepare men and women in such a way that they will be able to meet technological changes and overcome unemployment due to technological obsolescence
(d) provide greater democratisation in education and to serve both individual and social needs.

Clearly Defined Aims and Objectives of Vocational Education

In line with the stated definition and role of vocational education, it is obvious that there are enormous implications for the vocational education curriculum. In the formulation of curriculum in vocational education, it is essential to be able to work from certain established principles. For the curriculum to be relevant and in line with the needs of the country, it is most important that relevant principles and issues are clearly and carefully addressed.

Every nation's vocational education programme should have clearly defined aims and objectives. These must be spelt out in unequivocal terms. Sudden and frequent changes in objectives will hinder the smooth development of vocational education and its curriculum. Without a clearly defined direction the curriculum will be subjected to incompatible demands. It will be a curriculum without "objectives". Without doubt curriculum contents must necessarily change from time to time to reflect changing needs and technological developments but the very basic and crucial principles of vocational education must be explicitly defined and agreed upon by all.

The Position of Vocational Education in Relation to the National General Education System

This would have implications as regards the target group of students for vocational education and the articulation of the vocational education curriculum. Whatever the overall objectives, the development of the curriculum must necessarily be suited for the target group of students. The curriculum must also reflect the articulation necessary for entry into vocational education and for studies after vocational education. It is needless to state here that vocational education generally must not be terminal. To allow it to be so would be wrong for the many students in the system who have the ability to benefit from vocational education. In the context of the changing nature of vocational education of today, the fast changing technological advances and the trends and directions of development of vocational education, to do so would mean not understanding the nature and needs of present day vocational education.

The Vocational Education Curriculum Must Reflect Changing Technological Needs

The most substantial development for vocational education, during the last few years and also for the near future, will be the response to the changing nature of vocational education itself. This will be the biggest curriculum challenge for vocational education planners and managers for the 1990's. In many areas in vocational education, the world of work has moved from the manual craft trade nature into a vocational education of a higher technological, sophisticated and of a more cognitive nature. This is brought about by developments in electronics, robotics, miniaturisation, automation and a wide range of futures technology. This changing trend will accelerate in the years to come and is often difficult for the vocational education curriculum which has traditionally been manual craft and less cognitive in nature. The curriculum must necessarily now move to a different level of academic emphasis and heed the call for higher levels of abilities in the cognitive domain. There is a greater need for application, analysis, evaluation and synthesis levels of abilities. The curriculum must recognise and reflect this changing trend and must also cater for the change of attitudes and perceptions of vocational education that will inevitably come with these technological changes.

General Education Components in Vocational Education

An often repeated criticism of the vocational education curriculum is that it includes general education and that this is a waste of time. General education may be wasted on students who do not have the means or the desire to benefit from it. It may be unnecessary for the still very manual trade skill areas. However, many areas of vocational education do need general education and vocational education students of today will benefit from it. This is all the more true in view of the above changing technological trends. In addition, it is becoming more accepted everywhere that all programmes should include a component of general education as modern life requires increasingly a higher level of general education. General education in the vocational education curriculum, however, must be closely related to the needs of vocational education. With the progress of modern industrial technology, this component of general education becomes more important. More and more traditional manual skills have given way to modern machinery and equipment where the emphasis is moving towards a more theoretical understanding rather than actual total manipulative skills. It is relevant for the vocational education curriculum planners to note that the craftsman of today and tomorrow must know more about mathematics and science than his predecessor. Providing up-to-date instruction in these related general education components in the vocational education curriculum is becoming as valuable as the instruction given in trade skills.

The Broad-Based Vocational Education Curriculum

The amount of literature and arguments on this issue is as old as vocational education itself. However this is proving increasingly true as the changing trends is slowly but surely reinforcing the position. A re-statement of the need for a broad-based curriculum in vocational education is as follows:

(a) it is needed to provide a broad foundation which gives would-be workers greater flexibility and resilience to changes in technology and changes in the employment market. It is a guard against "technological obsolescence"
(b) technology is becoming more complex and the need is increasingly towards more maturity and lower initial training. The curriculum should be directed towards a preparation of students that is initially broader in nature and more specialised in later stages if necessary
(c) modern technologies need workers with a broader breath of view, more knowledge and skills, and a greater adaptability to change. Many vocational areas today require knowledge in more than one area. Industrial changes today are reducing or eliminating old skills and are creating demands for new types of skills. "Vocational mobility" is increasingly important in today's world of changing technology. The uneducated or the narrowly trained becomes obsolete and the cost of retraining today is prohibitively high and very time consuming and tends to be very inefficient in a vocational education system.

The need for a broad-based curriculum in vocational education is being reinforced by day-to-day developments and the direction of future trends. The need for a broad-based curriculum should no longer be doubted.

Mini-Case Study 1 - The New Vocational Education System

Vocational education in Malaysia is carried out in Forms 4 and 5 (Grades 10 and 11) parallel to the general education streams. A recent development in vocational education in Malaysia was the introduction of a new system for vocational education in 1987 incorporating the above philosophies, objectives and approaches.

Under the new vocational education system, students undergoing a particular course follow a common curriculum in the first year during which they undergo a continuous assessment system and are given guidance and counselling. In this year, students are able to determine their inclinations, interests and capabilities in the fields which they have chosen. In the second year, students are then given a choice to enter the more academic concentrated vocational stream or the more practical oriented skills stream. In the vocational stream, students are given a strong emphasis on academic subjects and a technological oriented studies to provide them with a better foundation for a possible further education in technical colleges and polytechnics without significantly affecting vocational skill development at the required level. The academic subjects taught are at par with similar subjects in the general education streams. In the skills stream, students are given more time on practical training to provide them with a higher proficiency in trade skills as required by industry.

Students from the skills stream are also able to undergo more advanced training at the vocational schools.

Besides these two-year courses, the system also provides short and specialised programmes of one year duration. Students, after completing Form 3 (Grade 9), who are interested in pursuing vocational education but do not want to follow the two year programmes, can enrol for the one-year basic short course in a specific skill area. This course is a more practically oriented programme than the two-year course and is designed to meet industrially required skills standards. The new system also has specialised one-year courses designed to cater for students who have done well in their vocational studies and are interested in pursuing further one-year advanced training in a specialised vocational area.

The objectives and structure of the new vocational education system is in line with the objectives of raising the general technological literacy of the people to face technological changes; to provide an infra-structure and a technological base for the supply of skilled manpower; to prepare students to meet technological changes and overcome technological obsolescence; and to provide greater democratisation in education and to serve both individual and social needs. It has in addition managed to put in clearer perspective the position of vocational education in relation to the national general education system. The new system has also facilitated the development of vocational education curriculum, that will meet changing technological needs, that includes general education and that is broad-based.

Mini-Case Study 2 - A Total Coursework System for Engineering Trade Courses

Practical work is an important component of vocational education. To further complement the implementation of the new vocational education system and the achievement of its objectives of facing technological changes and to meet the changing nature of a more sophisticated and cognitive vocational education that calls for a greater need for the abilities of application, analysis, evaluation and synthesis, a total coursework system for engineering trades was developed and implemented in 1987.

The practical projects in the coursework system were developed through a skill matrix system and a criterion-referenced evaluation system is extensively used. The coursework system calls for self-evaluation by the students of their own practical work in specially designed assessment forms which leads towards a skill profiling of the students' practical abilities. So that every student could have a copy of the coursework book, the Ministry of Education, Malaysia, funded the printing and dissemination of these materials to all secondary vocational schools. Students could then have a permanent record of all the practical projects carried out in a single document for presentation to would-be employers and other interested parties.

The Vocational Education Curriculum - Future Needs

The curriculum in any educational programme can be considered as one of the most critical components determining the success or failure of the programme. This is also true in the case of the vocational education curriculum. In fact, this issue is more critical in the case of vocational education as it is often under close scrutiny and not clearly understood readily by a lot of people who will have no hesitation in levelling constant criticism at and demanding unrealistic expectations from vocational education.

The actual technical contents of the curriculum will often have to change and be up-dated and up-graded. Various methodologies exist for curriculum development in these areas. However, certain principles of the curriculum should not change. Having established these principles and issues, the curriculum is then developed accordingly. This paper has attempted to address this aspect of the vocational education curriculum and the issues involved. To a large extent, it is based on the Malaysian experience and the development and evolution of vocational education in Malaysia. It is hoped that these views and experiences find commonality and will be useful to other developing countries, where vocational education is relatively "young", slowly "maturing" and "searching for directions" to evolve into a vocational education system that will take its proper place in the hierarchy of the nation's education system.

Conclusion

I certainly do hope that some of the issues raised in this paper will result in meaningful discussions that will be of benefit to all of us. It is amazing to note that with all the tremendous amount of research and development being carried out throughout the world in this fascinating area of vocational education, what we know today is still very much like a tip of the ice-berg, with so much more that needs to be explored. As we find solutions to existing issues, new issues begin to emerge. With the sharing of experiences in conferences like this and perhaps with a little patience, hopefully we can look forward optimistically to providing more effective and meaningful vocational education programmes in order to maximise the potential of available human resources in our respective countries.

Biographical Data

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Recent Initiatives in Staff Development in Vocational Education in Scotland

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Introduction

The purpose of this introduction is to describe briefly the arrangements for the delivery of vocational education in Scotland as a backcloth against which to see the provision for staff development. Vocational education, pre-service and in-service, for craftsmen and technicians, their counterparts in business and commerce, and support staff in the caring professions is referred to as formal further education (1). For administrative purposes this is further divided by the Scottish Education Department (SED) into non-advanced further education (NAFE) and advanced further education (AFE).

NAFE makes provision for occupations such as bricklaying, welding, plumbing, catering, secretarial work, retail distribution, motor vehicle mechanics, first line supervisors in manufacturing industry, agricultural, fishing, horticultural and forestry work, textile manufacture, nursery nursing and many more. The objectives of NAFE are predominantly concerned with the abilities to recall, understand and apply basic information and skills. On the other hand AFE makes provision for occupations where the additional abilities to analyse, synthesise and evaluate are also very important in, for example, leisure and recreation management, industrial design, engineering production technology, computing systems analysis, surveying, travel and tourism, accountancy, insurance, marketing and banking.

The major providers of NAFE are 50 further education colleges which are supported by Local Education Authorities (LEA) i.e. local government agencies. These colleges serve some 200,000 (2) students with 7000 academic staff. However a limited range of NAFE courses are offered in secondary schools for pupils who have chosen to remain at school beyond the statutory leaving age. There are in addition a few private agencies which provide a very limited number of courses. Small numbers of course modules are also provided in some of the Scottish Central Institutions. These are colleges which are funded by direct grant from central government and which are controlled by boards of governors. The vast majority of their work is at advanced and degree level.

In 1983 the SED introduced an Action Plan (3) for the reformation of NAFE which culminated in the introduction of a single qualification. This qualification called the National Certificate replaced a whole range of separate certificate and diploma awards. It is awarded by the Scottish Vocational Education Council (SCOTVEC).

Under the Action Plan the entire NAFE curriculum was reorganised into a modular form and a vast catalogue of National Certificate modules - more than 2500 - has now been introduced. This enables individual learners and/or their employers to concatinate modules into programmes of study which best meet their needs.

Each module is characterised by a unique descriptor (4) which includes as well as its name and National Certificate catalogue number the following features:

a) a list of learning outcomes - usually four to six,

b) subject matter content or alternatively a statement of context in cases where the module is process-centred,

c) suggested teaching/learning methods for the delivery of the module,

and d) a recommended mode of assessment.

All modules are associated with forty hours of teaching/learning activity which also includes the time for both formative and summative assessment.

The lecturers and teachers who deliver the modules are free to design and implement whatever teaching/learning approaches they choose, provided the learner overtakes the prescribed learning outcomes. Learning outcomes are sacrosanct. Although methods of assessment are strongly recommended, alternatives are acceptable where they are agreed in advance by SCOTVEC external assessors.

A major overhaul of AFE is now under way (5). In the current piloting phase new and replacement courses for the existing provision are being constructed in the form of units. These units may be of variable size in terms of study time. Credits will be accumulated for units successfully completed with a notional 40 hours of successful learning activity being associated with one credit.

Three awards are available, viz:-

(1)	Higher National Certificate	12 credits
(2)	Higher National Diploma	30 credits
(3)	Higher National Unit Certificate	

The first two of these are awarded for groups of units in specific subjects, e.g. electrical engineering, management, or even rock music performance. The third award offers learners a means of recording individual units which have been successfully completed.

Staffing in Further Education Colleges

Hierarchical management structures are the norm in the Scottish colleges. Every college is managed by a council which reports to the local education authority. Membership of the councils represents the interests of the industries, businesses and the communities served by the colleges.

The Principal of the college is in effect the chief executive officer of the college council. In most cases the principal is supported by a vice-principal, a number of assistant principals, heads of departments, senior lecturers, lecturers and a range of technical, administrative and secretarial support staff. Assistant principals commonly have college-wide responsibilities for learning resources, staff development, marketing, etc. Heads of departments are responsible for courses in particular fields of study, building technology, office arts, science and mathematics, and so on. Senior lecturers are responsible to heads of departments for particular aspects of the work of departments: for example, in a department of business studies there might be senior lecturers responsible for word-processing, book-keeping, business law, banking, etc.

The great majority of academic staff are recruited to the further education service directly from industry and commerce. Thus, for example, it is possible to be a practising department store manager on a Friday and a lecturer in retail subjects in a college on the following Monday; not by any means a straightforward transition. In a minority of cases teachers from secondary schools find posts in further education colleges and under the regulations regarding preparation for secondary teaching in Scotland they will have undergone pre-service initial training. However for the staff recruited from industry there is no pre-service training for teaching in further education. There is no way of predicting sufficiently far in advance what the demand is likely to be for lecturers in particular subject areas for a total teaching force of about 7000 which has an annual turnover of about 300 to 350. This was the considered view of the committee of enquiry - the Robertson Committee (6) - which was set up by the Secretary of State for Scotland to examine the entry of teaching staff into further education and the provision for professional training. Following in the wake of this committee's recommendations a pattern of training has evolved which includes three main areas of provision, viz:-

1. induction courses for newly appointed staff

2. initial training leading to a recognised teaching qualification

3. post-initial training opportunities to provide for continuing professional development.

Most of this training takes place in the School of Further Education (SFE) at Jordanhill College of Education in Glasgow. The SFE is Scotland's national centre for staff and curriculum development for further education. It is the sole agency which provides staff development courses which lead to awards.

Until 1983 almost all staff development for further education in Scotland had some connection with the SFE. Recently however, Local Education Authorities have been introducing in-house programmes of training in the further education colleges themselves to provide additional support for staff development relating to specific course provision in individual colleges. These developments have been patchy: some colleges have done rather better than others. In some colleges good arrangements have been made involving some release from normal teaching duties but other colleges have been less well organised. Overall there is a trend towards more systematic provision for staff development at local level but it is not yet clear what the final arrangements might be. The remainder of this paper therefore focuses on the national provision made by the SFE mainly for the 7000 lecturers in the further education colleges.

Induction Courses

The contribution of the SFE to the provision for the induction of new staff into the further education service is described here briefly in the interests of completeness. Induction courses into teaching in further education are provided by the SFE in the autumn term (September, October and November) and in the winter term (January , February and March). They take the form of one week of attendance at the SFE at the start of the term followed by tutorial visits to course members in their own colleges where their teaching practice can be observed and, if there are glaring deficiencies, remedial help given. The course is rounded off by a further two days of attendance at the SFE. These courses are intended to provide a teaching survival kit which will prevent the onset of bad habits before the commencement of initial training. Sometimes when there are sufficient numbers of new staff in a particular college - fifteen or more - the SFE will send tutors to provide in-house training, thereby saving the cost of sending staff to the national centre.

Recent research by the Scottish Council for Research in Education (SCRE) (7) has shown that although the SFE courses are well received they attract only a small proportion of the new entrants to the profession. The inadequacy of existing provision in meeting needs locally and nationally has been exposed and the necessity for the introduction of effective in-house induction programmes is consequently a very live issue.

What the Robertson Committee had hoped for was that new entrants to the profession would immediately be enrolled for initial training or at least would commence such training during the first year of service. Given impetus from the SCRE research findings this may become less of a pipe-dream.

Initial Training

The Certificate of Education (Further Education) awarded by Jordanhill College is a Teaching Qualification (Further Education) - TQ(FE) - as prescribed in the 1967 regulations governing the entry to the teaching profession in Scotland. It is the hallmark of the professional teacher in the further education service in Scotland and those who hold the qualification are entitled to register with the General Teaching Council (GTC) for Scotland. The course is accredited by the GTC and validated by the Scottish Council for the Validation of Courses for Teachers (SCOVACT).

Prior to 1986 the TQ(FE) course was offered on a four-term thick sandwich format made up of one term of attendance at the SFE followed by two terms of teaching practice and completed by a further term of attendance at the SFE. However in the early 1980's the further education colleges found it more and more difficult to release staff to the course and numbers dwindled steadily from an enrolment of just over 180 per year to fewer than 160. A very substantial backlog of staff awaiting training built up. Scotland has always prided herself in the levels of professional competence of the teaching force. The record of almost 80% professional trained teaching staff which had been sustained throughout the 1970's and into the 1980's was seriously endangered. The underlying cause had to be sought out and the declining trend reversed.

The reason for the decline in the numbers of staff coming forward for training turned out to be simple. The new modular arrangements for NAFE resulted in staffing constraints which gravely impeded the release from normal teaching duties. No longer could the luxury of "off-the-job" training in full academic term blocks be afforded. Although staff could be given remission from teaching it could not be for lengthy periods: it had to be on a proportion of hours per week. A change had to be made in the ratio of "on-the-job" to "off-the-job" dimensions of initial training but this posed the question of how it might be achieved (8).

The answer lay in adopting a task-centred approach allied to teaching/learning at a distance which counted on three kinds of support:-

1) regular tutorial visits to course members at their place of work

2) a telephone tutorial service

and 3) trained mentors in the course members' own colleges.

Agreement was reached with the SED, GTC, employers and lecturers' professional organisations (trade unions) for the introduction of a delivery system for initial training which, while incorporating new ideas, was at least as demanding as the course it replaced. This innovation halted the decline in the numbers coming forward for training and then reversed it to a point where recruitment to the most recent course stood at 200.

Under the new arrangements the hours of study remain the same, 1200 hours, but of that 900 hours now take place in the course members' own colleges. Remission from 200 hours of class contact activity is granted to course members to undertake the distance learning work in addition to the 300 hours of block release to the SFE. The new course extends over five terms and is arranged in seven blocks as shown in the following table.

Year 1	
Block 1	Four weeks of continuous full-time attendance at the School of Further Education during April/May or alternatively May/ June
Block 2	Distance Teaching/Learning and Tutorial Visits during September, October and November
Block 3	One week of full-time attendance at the School of Further Education in December
Block 4	Distance Teaching/Learning and Tutorial Visits during January, February, March and early April
Year 2	
Block 5	Four weeks of continuous full-time attendance at the School of Further Education during April/May or alternatively May/June
Block 6	Distance Teaching/Learning and Tutorial Visits during September, October and November
Block 7	One week of full-time attendance at the School of Further Education in December

The Curriculum

The course is concerned with promoting the abilities, skills and attitudes of the self-monitoring professional teacher. It addresses the practical tasks of teaching in a variety of settings, classroom, laboratory, workshop and it also examines wider issues affecting professional practice.

There are three main components, viz:-

1. "Teaching Methods" which is concerned with the development of teaching competencies.
2. "Theories of the Instructional Process" which is concerned with the theoretical underpinning of practice.
3. "Education Studies" which are concerned with wider issues relating to the further education system and the curriculum.

Task-centred teaching methods together with independent study exercises have been adopted for all three components. Tasks are described and discussed in blocks 1, 3 and 5 and carried out in blocks 2, 4, 6 and 7. Some of the tasks relate to planning and preparation for teaching together with the maintenance of a record of professional practice. Others focus on curriculum development as well as the exploration of current issues and future trends in vocational education.

The range of tasks is kept under review and in the most recent course these tasks were as follows:-

1. **Record of Professional Practice.** Course members are required to maintain a record of their professional practice throughout the course. A record book is supplied to help course members monitor the effectiveness of their own teaching during Blocks 2, 4 and 6. Used in conjunction with written comments made by tutors on tutorial visits, this is used as a basis for discussion during Blocks 3, 5 and 7 at Jordanhill.
2. **Education Studies.** In Block 1 course members are introduced to considerations about the nature of vocational education and the further education system in Scotland. During Block 2 these studies are extended using distance teaching packages to the provision made in three other countries, the USA, USSR and Tanzania. This work is formally examined at the beginning of Block 3.
3. **Lesson Planning Exercise.** This exercise is introduced in Block 1, completed in Block 2 and discussed in group sessions in Block 3. Course members are required to produce detailed lesson plans for 8 hours teaching/learning. Plans should demonstrate that realistic consideration has been given to an overview of the factors which put the lesson plan in context, a statement of intentions, a strategy for assessment; a description of teaching/learning methods, utilisation of resources, and strategies for evaluation.
4. **Theories of the Instructional Process.** In Block 1 course members are led to an understanding of human potential for intellectual and personal growth through

acquisition of cognitive, social and practical skills. This work is extended to Block 2 and formally examined at the start of Block 3. Thereafter in Blocks 2, 3 and 4 course members are required to examine the relation and application of one learning principle to a learning programme relevant to a particular group of further education students and to submit a report of 2000 to 3000 words.

5. **Elements of the Curriculum.** Course members are introduced to wider considerations of the curriculum in Block 3. They are then given a distance learning package which they must complete in Block 4 to pave the way for a very substantial curriculum development exercise in Block 7. The package is designed to help course members consider in detail various aspects of the concept 'curriculum', to develop a model of the elements that make up a curriculum, and to consider their own role in curriculum design and development. All tasks in this package are self-assessed.

6. **Thematic Studies**. Course members study two educational themes in depth during Block 5. These result in the submission of two reports which must show evidence of reading, analysis and evaluation of developments in the chosen fields, and the relationship of material studied to course members' own professional situations. Members are currently able to select themes from the list below:

   (a) Understanding People

   (b) The Social Psychology of the Interview

   (c) Learning to Teach in Further Education: The Development of Training for Teaching in Vocational Education in Scotland

   (d) Society and Education

   (e) Education, Vocational Preparation, Life and Leisure in Eastern and Northern Europe

   (f) From Butler to Thatcher 1944-1988: British Educational 'Revolution' and Scottish Consequence

   (g) A Study of Educational Thought

   (h) Evolution of Post-School Education

   (i) Information About China's Education

   (j) Theory and Practice of Comparative Education

   (k) Education in a Multicultural Society

   (l) Industrial Management Skills

   (m) Aspects of Social Education

7. **Curriculum Development.** In Blocks 5 and 6 course members are set an extensive exercise which gives experience of curriculum design including aspects of planning, implementation, evaluation and revision. The exercise draws, where appropriate, on the concepts learned in the Teaching Methods, Theories of the Instructional Process and Education Studies components of the course. This exercise involves the completion of an assignment of 5000 words or equivalent.

8. **Professional Development Project.** During Block 7 course members, divided into project groups of about eight are required to undertake a major case study based on a hypothetical FE college in Scotland. It entails considering the design of a short staff development course, the design of a scheme for on-going staff development and the design of a curriculum innovation system for the whole college. This is a team building activity and it is informally assessed by tutors.

Tutorial and Counselling Services for Initial Training

Reference has already been made to three kinds of services provided for course members, viz:

(a) visits by SFE staff to course members in their own colleges

(b) telephone tutoring where students can be in contact with SFE staff on a regular basis

and (c) day-to-day support by mentors.

The first two of these, (a) and (b), require little explanation. There is a total of eight tutorial visits, spread over the distance teaching blocks, 2, 4 and 6. During these visits guidance and supervision is given in relation to the tasks in hand. In addition, on five occasions there are assessments of teaching performance. A telephone tutorial session is always initiated by SFE staff a week or so in advance of each tutorial visit but additional help may be sought from tutors at any time.

The mentoring system has financial backing from management and is approved by central government, i.e. the SED, and the lecturers professional organisations, i.e. the teaching unions. All mentors must hold an appropriate teaching qualification. They must also occupy posts at the level of senior lecturer or above and they must have a place in the management structure of their colleges. Nominations for the appointment of mentors are made to the SFE by the various further education colleges and central institutions which support the TQ(FE) course. Appointments are only ratified after successful completion of the induction course for prospective mentors which is provided annually by the SFE. At the time of writing there are 173 approved mentors in post.

Broad guidelines are prescribed for the mentor role. These specify responsibilities in relation to the administration and management of the distance teaching parts of the course and they assign to the mentor the task of academic counsellor. At the time the new course arrangements were being negotiated with unions, employers and the SED there was pressure from one or two LEA's to be very specific about mentor duties. This was resisted however since the balance of opinion favoured broad guidelines in the first instance which could be fleshed out later in the light of experience.

One issue proved contentious: the locus of mentors in the formal assessment process. Employers and unions agreed that mentors should not be required to make judgments about the teaching competence of their junior colleagues. The GTC took the opposite view, arguing that the mentors were very well placed to appraise the performance of course members. The employer/union view prevailed and the job of formal assessment of course members is assigned exclusively to the staff of the SFE. However recent changes in the conditions of service of further education lecturers seem likely to result in the introduction of staff appraisal systems and the debate about the locus of the mentor in the formal assessment may well re-emerge.

The fleshing out process mentioned above is now under way. Funds were made available by the SED for a modest research study of a selection from the mentoring systems which had been put in place by different colleges (9). No best system has been identified but a number of examples of best practice are described in the project report. The research indicates that it is neither possible nor desirable to devise a single mentoring system which would be applicable in all colleges but colleges are advised to bear the following points in mind when reviewing their systems:-

1. systems should be pro-active, not reactive

2. whenever possible all course members in a college should have some common remission from teaching duties to enable them to meet as a group with mentors

3. where colleges operate on more than one campus consideration should be given to the provision of mentoring services at each site where there are course members.

In addition to this research study the opinions of all mentors have been sought as to the scope and purpose of mentoring. It is likely that an enhanced tutorial function for mentors will be proposed at the quinquennial course review.

Post-Initial Award-Bearing Courses

In order to facilitate the 1983 reformation of NAFE the SED set up various working parties and task groups. One task group was given the job of exploring the staff development implications of the reform. Although important changes in initial training were necessary wider needs were identified for programmes which would provide familiarisation with the new curriculum for all further education lecturers. These considerations led to growing recognition for the concept of continuing professional development. The SFE was invited to devise a staff development scheme beyond initial training which would provide a central thrust to continuing professional development at national level.

As with the new arrangements for initial training employers, unions and the SED were consulted about possibilities and in 1986 a scheme for award-bearing post-initial courses was approved by these bodies and validated by the SCOVACT. These courses are open to further education lecturers who hold an approved - by the GTC - initial training for teaching qualification.

The courses seek to extend and develop professional knowledge, skills and attitudes by requiring course members to:

a) adopt an analytical, problem-solving approach to educational and related problems

b) consider alternative approaches to teaching and learning

and c) produce teaching and learning support materials.

They take the form of concatenations of modules selected from an "a la carte" menu to meet the particular needs of individual lecturers. Choice of curriculum is held to be especially desirable and the responsibility for coherence of programmes of studies is delegated to course members under guidance from SFE staff and staff tutors in the further education colleges.

Each single module attracts one study credit and demands the equivalent of thirty hours of class contact supported by roughly the same amount of private study. Double modules - 60 hours each - are available and they attract two credits. These may only be taken after eight single modules have been completed.

Awards are made on the basis of credits accumulated, viz:

1. Certificate in Post-School Education Studies - 4 credits

2. Diploma on Post-School Education Studies - 12 credits

3. B.Ed. in Post-School Education Studies - 16 credits

Candidates for the degree must include at least one double module in their programmes of study. Certificate and Diploma awards are made by Jordanhill College of Education and the Degree award is made by the University of Glasgow.

Modules are delivered in a variety of modes: some require attendance at the SFE for up to five days and, of course, this necessitates release from teaching duties. Others are provided wholly or in part by distance teaching methods. Flexibility of delivery is of paramount importance to make career development opportunities equally available to staff in colleges far from and near to the SFE. If ten or more course members in any one college or in any group of colleges in a region wish to study the same module at the same time special arrangements can be made for it to be delivered on an outreach basis in a local college.

Modules are classified in six categories:

A Teaching and Learning

These modules are concerned with the activities of teachers and learners and their interactions, e.g.

A3 Design of Games and Simulations
A5 Introduction to Study Strategies
A7 Self-appraisal of Teaching Performance

B Curriculum Development

Modules in this category relate to specific curriculum issues, e.g.

B2 Curriculum Development in National Certificate Modules
B5 Open Learning: Management of an Open Learning Scheme

C Educational Management

For those course members who want it the range of modules available under this heading gives systematic coverage of the subject, e.g.

C3 Induction Training
C5 The Marketing Approach to Post-School Education
C6 Computer Literacy

D Special Educational Needs

These modules provide course members with a knowledge of the nature of special educational needs and the problems associated with them, e.g.

D1 Students with Special Educational Needs
D2 Learning Difficulties in Post-School Education

E Guidance and Counselling

Modules in this category are intended to help develop awareness of guidance and counselling matters and to provide course members with opportunities to develop specific skills, e.g.

E3 Guidance Services in Post-School Education
E4 Student Supervision
E5 Stress Management

F Current Educational Issues

The purpose of this group of modules is to provide the opportunity for the examination of issues which cross over the boundaries of the other modules and which deal in a more general way with the relationship between education and society, e.g.

F1 Women, Education and Employment
F2 Data Analysis

Each year new modules are designed by SFE staff and taken to a validation committee for approval before they are incorporated into the module catalogue. The committee operates on a partnership arrangement with delegated powers and membership drawn from the SCOVACT, the University of Glasgow and Jordanhill College. This partnership for validation means that new module development is comparatively unencumbered by bureaucratic procedures.

At the present time there are 29 modules in the catalogue and there are more than 250 course members enrolled for the degree. About three-quarters of lecturers in further education have technical as distinct from degree qualifications and these new courses present a unique opportunity for this majority to attain the same status as their graduate colleagues. In so doing they feel that promotion prospects are equalised.

Post-Graduate Courses in Education for Further Education Staff

The University of Glasgow has a very long tradition of providing quality post-graduate courses in education for experienced teachers and education administrators and in 1984 with the aid of the SFE extended this provision to the further education sector. A new M.Ed. (FE) degree was mounted which consisted of eight 60 hour modules, viz:

1. The Provision of Further Education in Scotland

2. Curriculum Issues in Further Education

3. Adult Education

4. Theory of Education

5. Seminars on Contemporary Issues in Education

6. & 7. Major or Minor Research Exercise in the field of Further Education

7. & 8. Optional Study

Modules 1 and 2 are taught by the SFE using distance learning methods and research studies - modules 7 and 8 - involving further or vocational education topics are supervised jointly by SFE and University staff. (Where a programme of study includes a major research exercise only one optional study is taken while programmes which include a minor research exercise require two optional studies). Later in 1985 Aberdeen University incorporated the SFE modules into its M.Ed. programme and discussions are presently under way with the University of Dundee with a view to extending the SFE provision even more widely.

The post-graduate degrees have attracted only very small numbers, perhaps due to difficulties of the attendance requirements for the more traditionally taught University modules compared to the SFE ones. Plans are afoot to introduce a new M.Litt. (FE) however which will be a research-based degree delivered on an open learning mode. This degree will meet the general criteria of accessibility applied to other SFE courses and consequently will be equally available to all graduate teaching staff in Scottish Further Education colleges.

Staff Development for College Principals

None of the initiatives reported so far have been particularly appropriate to further education college principals. There is little attraction in award-bearing courses for those who have reached the summit of their profession but opportunities are needed for continuing professional development which are every bit as important as those of the unpromoted staff. In recognition of this need the SED, with the approval of employers and the Association of Principals of Colleges (APC) and under the guidance of a steering committee, made funds available to give every principal of a further education college in Scotland an opportunity to take part in an "action research" project relating to an aspect of management of further education. Almost every college principal has accepted the invitation to take part in the project.

Five working groups of principals have been formed, each supported by an assessor from the SED who is one of HMII (FE), a member of the Association of Directors of Education in Scotland - which is essentially the employers organisation - and two senior members of staff from the SFE. Each group is asked to investigate and report on a particular aspect of further education management at a seminar to be held in September 1989.

The topics under consideration are:

a) Curriculum Management

b) The Organisation of Marketing

c) Staff Development

d) Management Roles at Various Levels

e) Resource Organisation and Utilisation

Progress reports submitted to the steering committee in November 1988 would suggest that - at least as far as Scotland is concerned - a new and highly acceptable approach to staff development for its most senior managers is emerging. Clearly it is too early to be able to judge how effective the project will be but the signs are promising.

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VOCATIONAL EDUCATION: AN INTERNATIONAL PERSPECTIVE

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When asked to give/write a paper on vocational education around the world I found this an awesome task and responsibility. How could I, an American with experience with our system of delivery of vocational education, comment on the variety and permutations of vocational education world wide? My own research on the coordination of funds between two pieces of federal legislation, the Job Training Partnership Act and the Carl Perkins Vocational Education Act indicated that the local environment (defined in the broadest possible way) needs the opportunity and flexibility to address its unique situations in delivering services. The "culture" of a particular part of my own country would determine the relationship between the actors funded by the Job Training Partnership Act (Department of Labor) and those funded by the Carl Perkins Legislation (Department of Education). Knowing this, and trying to put it in the context of a world perspective, had led me to divide my paper into the following sections: Governance, New Governmental Initiatives, New Technologies, The Role of Business and Industry in Vocational Education.

Extensive review of the literature is not a substitute for qualitative primary data collection; generalizations drawn from the literature are just that, the subtleties can sometimes be lost. In trying to present both a concise and accurate picture of the situation there is always the fear that the complex set of dynamics in each country could be oversimplified. Having said that the literature points to many startling cross-cultural similarities.

The intent of this paper is to give the practitioner a global perspective and some direction in considering implementation of programming to prepare individuals for the world of work, maximizing success in the development and delivery of services. For the purposes of this paper vocational education will be defined as education and training that directly prepares individuals for the world of work. It may happen at the secondary school level, post-secondary school level, in a supervised work setting, or in a specially designed program.

GOVERNANCE

Given the variety of cultures and levels of economic development of countries the biggest concerns surrounding governance are: one, who and which agencies should be providing training; two, philosophical differences between the education community and the employment and training community as to how the training should be delivered. The literature supports the tension that exists between Departments of Labor and Departments of Education world-wide. This rift is played out at the program level in limited coordination of program offerings., sharing of expertize and equipment. The difficulty with mandated federal legislation for any country is that public policy designed at the national level cannot respond to regional differences; however, to work, it must be flexible enough to allow for response to the local environment.

NEW GOVERNMENT INITATIVES

Many countries have acknowledged both the need for local flexibility and the need to coordinate the efforts of employment and training programs funded by different federal agencies.

* The Turkish government in close collaboration with related agencies and coordination with vocational education was able to respond to an influx in their cities by revamping their entire vocational system of training.

* The European communities Joint Council of Employment and Education Ministers have agreed to provide, without cost, a six to twelve month training program to individuals after completion of a full compulsory education program. This training is designed to take place within the national policies and practices of the respective countries. As stated above it is critical that the programs "fit" into the context of the country. Also striking is that these programs are available to individuals after completing school so they are not in competition with the existing educational structures.

* Reform in the United Kingdom provides for a more independent local education authority that is linked directly with local employers.

* Youth Guarantee in Victoria, Australia was designed to provide full-time training/education and or work study in the public sector and liaison with TAFE.

All of the aforementioned programs are attempts by governments to address the overwhelming problems related to unemployment and an unskilled work force

NEW TECHNOLOGIES

Great concern exists world-wide regarding developing a work-force that is technologically skilled. Countries are concerned about their position in the world market . Can they compete? How does vocational education fit into the training of individuals for the new technology? Industrialized as well as developing countries are faced with the same dilemma regarding high technology. How much emphasis should we place on it in our schools? The effects of the new and emerging technology are world-wide; but, the unique environment of each country must be kept in mind. How the technology will be used and perceived will vary. This is a revolution, or evolution, that is only beginning. Developing countries will not need to proceed along the traditional lines of industrialization from manufacturing to high technology. They can currently access the same information, given our sophisticated telecommunications systems. Turkey is as concerned as Australia, New Zealand, Malaysia, Japan, the Philippines, Europe and the United States regarding the technological preparation of their young people.

The following initiatives are taking place to address this concern:

* In the United States as well as other countries it has been realized that vocational education needs to work more closely with business and industry in providing state-of-the-art training.

* In New Zealand industry provides training manuals and materials and act as "tutors" to help upgrade training.
* Samoa uses telecommunications to bring up-to-date training to its citizens.
* The PEP programs in Australia is an attempt to provide specialized technological training.
* The United States is seeing major shifts in production, marketing and skilled employment requirements as a result of international technological change.

The concern that our schools are not doing enough to train students and that our equipment is outdated and in short supply is expressed throughout the literature. The literature supports the need for a work force with strong general skills which enable workers to be flexible in transferring their skills to new applications as technology advances. There is uncertainty as to the percentage a country's work force that will be involved in the new technology; however, concern exists in many countries that currently too few individuals have the technological training needed to compete in todays world market.

An acknowledged challenge is that the new technologies are being developed outside of the educational system; thus, the relationship with business and industry is critical. In spite of our collective recognition that new technologies must be an integral part of vocational curriculum, the lack of state-of-the-art equipment is expressed by vocational teachers in the United States, India, Indonesia, Malaysia, Singapore, Thailand as well as Australia.

ROLE OF BUSINESS AND INDUSTRY IN VOCATIONAL EDUCATION

Business and industry have a great deal to offer in terms of providing equipment and training to the vocational education system.

* The commission of European Communities addressed the need for this cooperation by setting up a tripartite committee of governments employers and trade unions from all the member states.
* Union objectives in Australia are being considered in the context of the industrial environment and with commitment and collaboration with the government, employers, the community as well as those receiving the training.
* The German dual system in which employers provide training and the colleges recognize that training is probably the best example of school industry trade union collaboration.
* In Japan the educational system is broad-based; training begins on the job, provided by the employer. Most sizable firms have training schools often equal to college and universities.

CONCLUSIONS

The following conclusions are drawn from the literature as well as personal research of over 100 hours of interviews with key actors in the vocational system in my own country.

* All agencies need to work together cooperatively in order to most effectively provide the appropriate training models.
* Federal legislation needs to provide incentives for agencies to work together.
* Impediments to cooperation between agencies and business/industry

need to be removed from legislation.

* Governments need to provide a protective umbrella for risk-taking in cooperation between agencies and organizations.

* Success needs to be measured in the context of the local environments rather than national or international norms.

* Education and training can be transported from country to country but must be adapted to the culture and environment of that country.

* New technologies are going to greatly influence our future. The extent of the influence and how to prepare for it is of some debate.

* Vocational education actors want more access to new equipment and training.

* New technologies provide developing countries and industrialized countries with nearly equal access to information.

* Business/industry and vocational education need to work together to insure an educated work force.

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WORKSHOP A

Theme: Learning styles in vocational education.

Monday March 13. 11.30 am; Thursday March 16. 11.00 am.

Adelaide Room 1

Mr. John E. Nelson. Manager of International Activities Agency for Instructional Technology, Bloomington, Indiana USA. *Teaching Learning Skills as a Foundation for Technical Training.*

Dr. David Ross. Instructional Designer, Division of External and Continuing Education, Darling Downs Institute of Advanced Education. *Approaches to Instructional Strategies for an Information Based Society.*

Professor Marcelle Hardy. Research Coordinator in Vocational Education, University of Quebec at Montreal, Canada. *Socialisation and Cognitive Processes in the Appropriation of Technico-scientific Knowledge in Vocational High School.*

Dr. Wu Ming Hsiung. National Taiwan Normal University. *An Experimental Study of Incorporating Creative and Inventive Concepts in Vocational High School Curricula.*

Mr. Keith Gove. VCAB/TAFE Liaison Officer, Victorian Curriculum and Assessment Board. *Teaching and Learning in TAFE. Does TAFE sell its students short?*

Teaching Learning Skills as a Foundation for Technical Training

Focusing on The *Principles of Technology* Project

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Agency for Instructional Technology

ABSTRACT: Educators must be concerned with **how** and **what** students learn. Students must be able to learn as efficiently as technicians are expected to work. This session is about creating instructional materials that will teach the knowledge and skills that must precede technical training. It will focus on the cooperative development process used by the Agency for Instructional Technology and American and Canadian educators to produce the PRINCIPLES OF TECHNOLOGY pedagogy and learning materials.

The Agency for Instructional Technology (AIT) designs curricula and produces learning materials for American-Canadian schools. Evolving from a television library begun in 1962, AIT was established in 1973 to strengthen education through technology. In cooperation with state and provincial agencies, AIT produces and distributes video-, computer-, and text-based instructional materials. AIT is a non-profit organization.

Introduction

Rapid technological change requires workers to update their knowledge of new equipment and processes frequently. Consider the changing role of workers who repair office equipment. Twenty-five years ago offices had manual typewriters that were repaired by "typewriter mechanics." They were mechanics in the literal sense -- they dealt with physical principles of mechanical systems. Then electric typewriters began to appear and mechanics had to learn some of the principles of electrical systems.

Now many offices have electronic typewriters, word processors, computers, optical readers, and ink-jet and laser printers. Technicians must understand mechanical, electrical, fluid, and thermal systems just to work on the modern equivalent of a typewriter!

How can we, as educators, help students prepare for constantly changing workplaces? What should we teach them in preparation for careers as technicians?

> Basic job information? The skills to apply that information? Self-management of thinking behavior? Good work attitudes? The motor skills to perform the job?

In this paper we will examine those questions by exploring educational theory. We will identify the **learning skills** that technicians must acquire. We will then examine how those learning skills can be incorporated into a basic course for technicians, using an **applied science** pedagogy as the example. Finally, we will examine the method used by the Agency for Instructional Technology to create curricular materials.

Learning Skills

Learning involves more than just memorizing information. In fact, five broad categories of learning can be identified and defined in performance terms:

information—verbally stating facts or generalizations.

intellectual skills—applying learned information.

cognitive strategies—self-managing learning.

attitudes—choosing personal action.

motor skills—executing bodily movement (Gagné, 1974).

Consider an example from primary school -- a mathematics lesson for ten-year-olds about determining the area of a rectangle. The basic lesson begins with "area equals length times width" or "A = L x W." That information, by itself, is not very useful because it does not teach the student to use the formula. To prepare a future worker, the lesson should include applying the formula in real-life situations -- an intellectual skill. To enable the worker to adapt to changing demands in the workplace, the lesson should include inferring "W = A / L" -- a cognitive strategy. Furthermore, the lesson should supply opportunities for practice in writing the numbers and formula and help students become comfortable with mathematics -- a motor skill and an attitude, respectively.

AIT used this approach in MATH WORKS, a mathematics pedagogy presented in twenty-eight 15-minute instructional video programs for fifth-grade students. The first program does not simply present information by stating "A = L x W"; instead, students witness their peers using the discovery process to infer the formula. By observation, students learn to use intellectual skills, such as problem-solving, to apply known rules to new situations. They learn to use cognitive strategies, such as critical thinking, to manage their own learning processes. They develop positive attitudes towards mathematics by watching peers successfully cope with a difficult problem.

Teaching all five categories of learning skills ought to precede technical training. **How** to learn should be taught throughout education (Sloan, 1980). Also, learning skills should be taught in all curricula. The case for teaching learning skills, such as problem-solving, within the science curriculum is argued by U.S. Secretary of Education William Bennett:

> In science as in math, students should not simply be shown results. Theories should be explained, so that students can understand why they are useful. Science is not a blueprint for unthinking memorization. Students should learn how to solve problems, but they must also learn why their problem-solving techniques work. (Bennett, 1987)

It is the role of education to prepare students for entry-level postitions or training by teaching all five learning skills. In order to teach these skills, teachers must have appropriate tools. Following is an example of such a tool, an applied science pedagogy.

PRINCIPLES OF TECHNOLOGY

PRINCIPLES OF TECHNOLOGY is an applied physics curriculum for secondary vocational and technical students. It emphasizes problem-solving and consists of 1,500 pages of student reading in 14 texts, 76 instructional videos, and 14 teacher's guides complete with laboratory experiments, mathematics skill exercises, and demonstrations. It is offered as a two-year course, taught one hour a day for 180 days each year, in U.S. and Canadian schools.

This pedagogy has been adopted by 47 states. In his *James Madison High School, A Curriculum for American Students* Secretary of Education Bennett recently recommended "Principles of Technology" as an alternative to "Physics" for graduation credit in secondary schools.

PRINCIPLES OF TECHNOLOGY was created because only two percent of American vocational students were studying physics! To combat this dismal acceptance of traditional, theoretical physics courses, vocational educators created a new pedagogy that (1) teaches applied, rather than theoretical, physics; (2) emphasizes the analogous behavior of the four energy systems; and (3) focuses on problem-solving.

In PRINCIPLES OF TECHNOLOGY students spend 40 percent of their time in "hands-on" learning and 20 percent in mathematics labs. They study 14 principles as they relate to four energy systems. For example, the first unit teaches "force" as it is known in the four energy systems:

force in ***mechanical*** systems
pressure in ***fluid*** systems
voltage in ***electrical*** systems
temperature in ***thermal*** systems

Each of the 14 units deals with one principle as it applies to the four energy systems:

1) Force
2) Work
3) Rate
4) Resistance
5) Energy
6) Power
7) Force Transformers
8) Momentum
9) Waves and Vibrations
10) Energy Convertors
11) Transducers
12) Radiation
13) Optical Systems
14) Time Constants

The course helps students think in terms of systems instead of narrow specializations, enabling them to adapt and retrain more easily than if they had learned only a few skills.

PRINCIPLES OF TECHNOLOGY helps teachers create lessons that draw on resources far removed from the classroom. For example, video sequences about mechanical resistance teach "drag force" by showing airplanes in flight, with graphic overlays illustrating the concepts. They teach "friction" by showing the brakes on the flight deck of an aircraft carrier stop a jet airplane -- in two seconds. Through video, teachers can bring experts and their demonstrations into classrooms and yet remain entirely in control of interaction with the students and the way the program is shaped into learning experiences. By doing so, teachers are finding that more students are engaged in learning more of the time, that those who miss the impact of one medium may be affected by another.

PRINCIPLES OF TECHNOLOGY was developed by AIT, a consortium of 49 state and provincial education agencies, and the Center for Occupational Research and Development. It is one of 25 video-, computer-, or text-based pedagogies that AIT and American-Canadian education agencies have developed cooperatively. It relied extensively on formative evaluation and was tested by the consortium in 75 schools while it was being produced. Following is a description of the process used by AIT to create materials such as PRINCIPLES OF TECHNOLOGY.

Instructional Design and Formative Evaluation

Teachers cannot create tools like PRINCIPLES OF TECHNOLOGY by themselves; they lack the time, materials, expertise, and funding. Successful learning materials must have high technical, creative, and instructional quality. They should be integrated with other media so that they complement other classroom activities. They should have a carefully considered sequence of instruction, with each lesson building on preceding lessons. Finally, the content of the series of lessons should be new enough to facilitate improvement in classroom practice, but not so new as to require disruption of existing curricula (Middleton, 1979).

These learning materials must be created by experts who understand the science of teaching. For example, AIT's instructional designers cite the following principles of learning:

Active participation—forcing students to think along with the presentation.

Sequencing— from the simple to the complex, the familiar to the unfamiliar.

Chunking— presenting the right amount of information for the development level of the students.

Congruency—eliminating whatever is not tightly relevant (Thiagarajan, 1988).

Adherence to these principles allows the creation of highly sophisticated materials. The MATH WORKS video mentioned earlier contains a dramatic vignette about two children coping with a mathematical modeling problem. One of them has a rigid, literal perspective and cannot comprehend abstractions (a cognitive strategy); the other child gradually offers enlightenment with the recurring use of one simple word: "pretend." The program also presents the same information about a mathematical formula in three different situations: live-action drama, a studio-based teacher, and cell-animation. Thus, students are exposed to repetitive messages from different points of view, each presented in highly motivating situations.

The instructional design of AIT programming is verified through evaluation by teachers and other subject-matter experts; subsequent production of learning materials is based on that design. The materials then go through formative evaluation with preliminary drafts of scripts, videos, and teacher's guides being tested and then modified as the research suggests. Formative evaluation focuses on four criteria: student **attention** to the lesson, student **comprehension** of content, the nature of classroom **interaction** stimulated by the lesson, and the **appeal** of the lesson to students and teachers (Middleton, 1979).

The AIT Cooperative Development Process

AIT funds curriculum design and production of learning materials by forming a consortium of interested state and provincial education agencies in the U.S. and Canada. When a consortium funds a project (in the case of PRINCIPLES OF TECHNOLOGY, 49 agencies supplied almost four million dollars), it is not just financing production, but uniting as many as 60 education agencies in the design and evaluation of pedagogic materials. Subsequently, the schools within these member agencies have unlimited rights to use the materials for 12 years.

These programs have been successful because the cooperating agencies have committed their time and energy, as well as their intellectual and financial resources, to make sure the materials are designed and produced to meet their own needs. In addition, the states and provinces have worked to ensure that teachers have access to the programming, are trained to use it, and have the necessary related resources to facilitate its effective use.

Adapting AIT Materials

To use PRINCIPLES OF TECHNOLOGY outside English-speaking North America, many changes may have to be made: translations, technical conversion of videotapes, and cultural adaptations of the programs. The adaptation process relies on the AIT instructional design used to create the original materials; it assists in the creation of quality, locally attuned, educational materials. AIT offers, and encourages agencies to use, its formative evaluation process during adaptation, ensuring that the new programs are suited to the new students.

In some cases, English-speaking schools outside the United States and Canada use the programs as they were originally produced. In other cases, the programs are translated, a local host is added, or new printed material is created to assist student understanding. Occasionally, new video footage is produced to ensure that the programs present local cultural values. In all cases careful attention is paid to the creation of programs that meet local curriculum needs.

There are several examples of this transfer of instructional technology. PRINCIPLES OF TECHNOLOGY is being adapted for use in Bophuthatswana, Brazil, Mexico, and Turkey. In all four cases, AIT's design and evaluation methods are being used to enable producers to create materials that meet the special needs of each country. Just as this transfer of technology can be a shortcut for developing nations, more industrialized nations are also adapting North American materials to save time in the development cycle. For example, by adapting MATH WORKS rather than producing new programs, Israel will be able to introduce its new mathematics curriculum ahead of schedule and under budget.

Those are two of AIT's three favorite phrases: "ahead of schedule" and "under budget." Of course, the first is "teaching students."

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Approaches to instructional strategies for an information based society

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Introduction

In the early 50s and late 60s, we referred to the post industrial society. Today we refer to the information society. Many futurists agree that the current generation lives at the confluence of this transition. The persons that can disseminate and use knowledge in the information age will be the leaders of our society. Cross (1985) supports this by stating:

> "Ironically, the age of technology is necessarily the age of development of human resources. Unlike the fossil levels that provided energy for the industrial revolution, the technology revolution is fuelled by information that is a non-depletable, expandable resource. Moreover, it is self-generating, the more people use it, the more it expands." (p. 10).

The information society is dependent on the development of high technology. It is also safe to state that the reverse is also true. Many misconceptions exist about the concept of high technology, the most important of which is that most employees will be employed in high technology jobs. Current research reveals that workers will work in high technology industries, but few will hold high technology jobs.

Although the contribution of high technology to the work force will remain low, technological change will have a dramatic impact on many jobs. A high percentage of workers in the immediate future will require a competent grasp of information technologies. The educational system must change to accommodate the information society.

After completing this paper, the reader will be able to:

1 Define the term "instructional strategies" as used in the preparation of vocational/technical materials for the information age.

2 Explain why the study of instructional strategies is important in preparing educational materials for the information age.

3 Define the term "approaches" as used by Instructional Designers for vocational/technical programmes.

What are instructional strategies?

Once a lecturer or instructional team has established the goals for a unit and the content has been identified, selected and developed, a plan must be established to transmit the knowledge to the student. The total play may include several facets to ensure that everything interrelates and becomes a reality. This master plan for managing and facilitating the learning environment is accomplished by employing instructional strategies. It includes all the elements necessary in the teaching/learning process. Certainly the way the material is presented, known as the delivery system is a very important part of the total plan, but it is not the only part. The total scheme is important and includes curriculum development, activity planning, evaluation, etc., in addition to the delivery system to be used in the actual instructional process.

Today's vocational/technical educator must employ a wide variety of instructional strategies in order to be effective. The educator's role has changed to that of a manager or facilitator of learning, rather than a dispenser of facts and information. For this reason it is mandatory that the contemporary vocational/technical educator know as much about instructional strategies as possible.

The course content for many contemporary programs may be accurately identified, selected and developed; however, it will not be effectively transmitted unless the instructional team provides the right instructional strategies and opportunities for the student to learn the content. Today's content for the information age is different from yesterday's content. Therefore, different instructional strategies are needed if effective learning is to take place. An instructional team simply cannot develop and/or transmit contemporary knowledge needed by students in the latter part of the twentiety century and beyond using out-moded strategies of teaching. Instructional strategies must keep pace with and match the technological content that is a major part of contemporary educational programs.

One of the major concerns is that regardless of the delivery system selected, it must make the student an active participant rather than a passive spectator. Instructional strategies that are action and interaction oriented will bring about learning and achievement.

New learning theories are continually emerging to respond to the needs of individuals. Today, in a society bombarded with untold advances in technology, as vocational/technical educators, you must call upon the very latest research and knowledge available on how people learn. Therefore it is absolutely necessary that contemporary instructional strategies incorporate the latest and most appropriate approaches to presenting instructional materials.

As the instructional team begins to plan the unit materials, certain approaches to teaching begin to emerge. These approaches may be considered pathways to instruction. They will help the student accomplish certain goals. In this article "approaches" are defined as broad styles of presented instructional material. These approaches help to identify a broad plan of action to help accomplish the teaching necessary for the information age.

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When an instructional team has decided to incorporate various instructional strategies in the presentaiton of an educational unit, several approaches to instruction become identifiable. The instructional team has certain goals which guide them in determining how to approach the content of a specific unit. All of the following approaches should be considered when selecting instructional strategies:

1 Conceptual learning approach.
2 Interdisciplinary approach.
3 Social/cultural approach.
4 Problem solving approach.

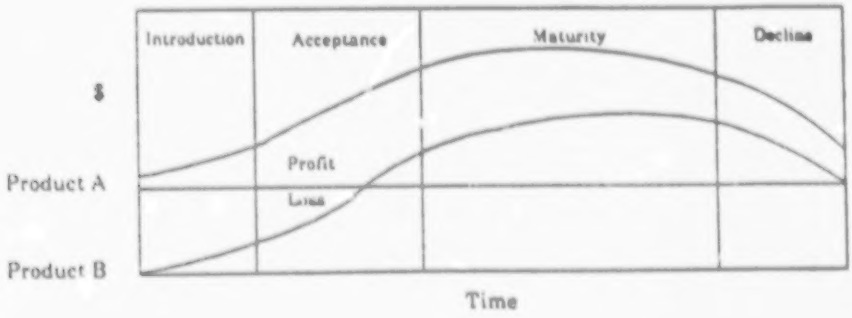
. Conceptual learning approach

The concept style of unit development involves identifying common concepts that are an integral part of the content of a unit and then teaching these concepts rather than teaching content only. The instructional team applies the content to the appropriate concept.

Conceptual learning as a concept is abstract compared to a concept like Modulus of Elasticity (Young's Modulus) but for an instructional team, say, in a vocational/technology program to be effective he/she must know both concepts. Abstract concepts are like fingerprints in that each is a fingerprint but each is different in its minute detail. Abstract concepts are like snowflakes in that each is called a snowflake but in actual configuration, each one is unique. So achieving similar mental images is the best that can be done when communicating an abstract concept.

Concepts are the resources that allow rational powers to be effectively and efficiently productive. Effectiveness is doing the right things (Drucker 1977). This means applying the correct resources in the correct ways. Efficiency is doing things right. This means achieving objectives using minimum resources.

Concepts provide unity out of variety, simplicity out of complexity. Concepts provide for efficient methods of organising information. In many cases concepts allow common bodies of information to be modelled into easily perceived graphic forms. For example, the potential for profitability over the life cycle of a product is a concept that can be modelled as shown in the following chart.



Conceptual organisation of information has become increasingly important due to augmentation and increasing complexity of many educational programmes. Complex areas of information, with multiple concepts and inter-relationships between concepts in differing combinations, constitute variables which are the bodies of information most applicable to conceptual organisation.

All indications are that the future will bring ever expanding bodies of inter-related information. This condition will continue to prompt the need for conceptual organisation to make information manageable, transferable and learnable.

. Interdisciplinary approach

Interdisciplinary instruction is another approach that should be used by the instructional design team in a vocational/technical programme. Interdisciplinary instruction is the process of relating other disciplines to specific unit content. This can be done by selecting common topics from other disciplines and combing them with specific unit content to show the inter-relationship.

To a degree all subject matter is integrative. The concepts and knowledge of different disciplines are used or should be used in teaching any subject matter. Rarely does a discipline exist and get presented as subject matter in a pure form. Teaching about an information based society for example, requires knowledge from mathematics, physics, sociology, history, literature and many other disciplines.

Teaching any educational programme with an interdisciplinary approach has several educational and political advantages. Although educational advantages are the prioity, the advantages gained by cooperating with other educators cannot be taken lightly. Cooperation and integration of subject matter is a desirable and increasingly more prevalent goal in education.

Educational advantages of using an interdisciplinary approach center upon the desirability of providing instruction which allows students to understand the relationship within and among the disciplines. In the application of knowledge the students begin to see how subject matter is related and may begin to value the contribution to knowledge and practice made in the various disciplines.

Planning and developing and interdisciplinary approach to teaching an educational unit can be challenging. The vocational/technology educator must either take on the responsibility for planning and involving others in the process. During the planning process, identification of adequate resources and subject matter knowledge becomes a concern. Choosing appropriate content from related disciplines can be difficult without adequate preparation in subject matter. Moreover, the basic concepts of a particular unit should not be lost in the interdisciplinary approach. Concerns about identifying interdisciplinary content, demonstrating the relationship of other disciplines and planning interdisciplinary lessons and activities must be addressed by instructional teams in an educational information based society.

. Social/cultural approach

This approach helps the student to understand the relationship the content of a specific unit has to culture. This includes how the unit influences the social system of a society. Understanding these relationships will contribute to making students have a better conception of the social environment.

Of all the various approaches that an instructional team could adopt, the social/cultural approach is the most appropriate for improving the awareness of how humankind interacts in a information based society. It expands the total curriculum to include both the positive and negative impacts of new technologies and how they effect the individual and his/her personal and professional lives. By expanding the technical knowledge base to include social/ cultural impacts, students will be able to increase their technological literacy level to help them deal with information technology related problems and opportunities for the purpose of better decision making.

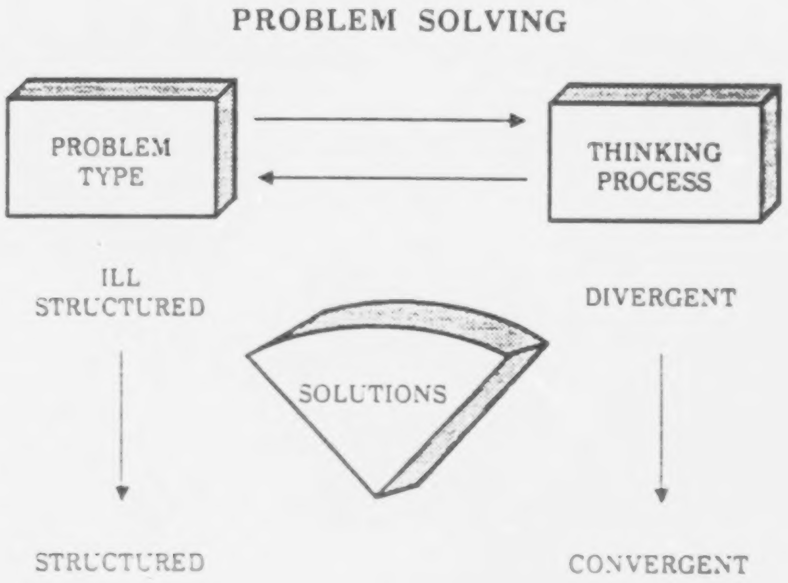
It is important to point out that only humans have the unique ability to pass on accumulated knowledge and culture from generation to generation (Lauda, 1986). Technology has allowed humankind to adapt to the environment even though we are not necessarily (physically) well prepared for it. That knowledge base is highly technological, and its accumulation has allowed us to advance our understanding and use of technology in a information based society. The rate of change associated with informational technological developments affect both our culture and personal value system. As we develop instructional strategies for any unit, it is possible to relate technical developments with human and technological factors. There are many people who live in a technological society but are technologically illiterate. Unless the basic technical information is provided, such a person would continue the avoidance syndrome and feel stress and conflict with his/her personal value system.

If education is to meet the needs of young people who will spend most of their lives in the 21st century, it will need to provide them with information and experiences that can meet the test of time.

. Problem solving approach

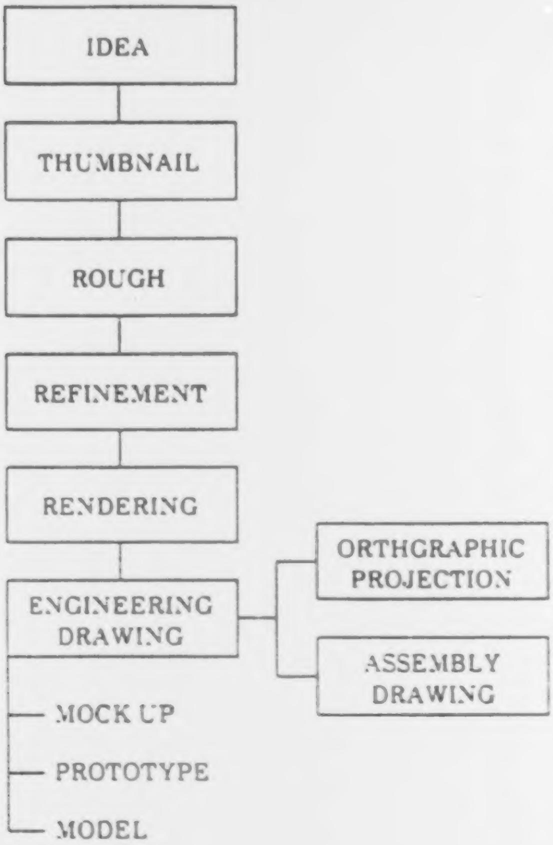
Problem solving has become a basic survival skill in today's information based society. Vocational/educational educators should provide an educational atmosphere in which students can gain skills in problem solving. When using the problem solving approach, vocational/technology educators become facilitators who provide solvable problems for the students.

Problem solving is a process - a process seeking feasible solutions to a problem. The process varies depending on the type of problem that is confronted. Van Gundy (1981) classified problems on a continuum of well-structured to ill-structured as depicted in the diagram.



The most structured problems are relatively narrow in scope and usually have only one correct answer. This type of problem forces students to use convergent thinking. They must examine the situation and arrive at the best solution. Typically, these problems are solved by using algorithms. However, they are no longer useful in developing the skills of a problem solver.

Semi-structured problems may have more than one correct answer and are solved by using heuristics. Heuristics are guidelines that usually lead to acceptable solutions. A set of heuristics might look like the following in a design problem.



At the other end of the spectrum are ill-structured problems that have a variety of potentially correct solutions. These problems require a more divergent thinking process to provide creative solutions. For instance, developing a better means of transporting people in an urban setting is a problem with a multitude of potential solutions. Finding solutions to this and other similar problems requires techniques of creative problem solving.

Problem solving has become a priority among many professions and the public. The approach calls for bringing to the instructional materials relevant technological problems combined with appropriate problem solving techniques. In written material, we can explain technological problems and problem solving techniques, but it takes well-designed student activities to learn first hand how to become a problem solver.

Conclusion

This paper has introduced several terms that are important for good instrucitonal design. Instructional strategies include all the elements necessary in the teaching/learning process. Instructional strategies are determined by the content as well as the philosophy of vocational/technical educators. It is believed that the information industries will contribute (Cordell, 1985) the major part of the economical growth of most major countries. Information is the raw material of the new economy and educational information/ units, must be designed to help individuals entering the work-force to figure out what they need to know, where to get it and how to use it in their productive activity.

Instructional strategies can be divided into "approaches" in presenting educational material. There were several approaches discussed that should be used by vocational/ technical educators. There were the conceptual learning approach, interdisciplinary approach, social/cultural approach, and the problem solving approach which can develop positive feelings and thus higher levels of motivation for students in the information age.

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SOCIALISATION AND COGNITIVE PROCESS IN THE APPROPRIATION OF TECHNICAL-SCIENTIFIC KNOWLEDGE AND PRACTICAL ABILITIES IN VOCATIONAL HIGH-SCHOOL.

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INTRODUCTION

Our research project on appropriation of professionnal knowledge is, at this time, in the gestation phase. We submit it to you in order to gather your comments and criticisms. After presenting the problem statement and the objectives of our research, we will specify its methodology and theoretical framework.

PROBLEM STATEMENT

The world of industry complains that the education system trains a labour force that is insufficiently versatile to adapt to technological changes. It is our basic assumption that vocational training which associates both the acquisition of technical-scientific concepts *(see below: definition of concepts)* and the acquisition of practical abilities permits the development of a more solid and more diverse competence, and thus fosters adaptation to technological changes.

In Québec, the students who enter vocational training average seventeen years of age. They must have succeeded ten or eleven years of general schooling, but success in physics or chemistry is not mandatory. Earlier works (Brunel, 1986; Hardy and Cote 1986) have shown that these students have a rather weak schooling experience, that they are essentially motivated towards production and acquisition of know-how directly related to production, but, are little interested in acquiring knowledge which does not appear to them linked to pragmatic accomplishments.

These students often display behaviours of resistance towards any theoretical presentation of professionnal knowledge, and downgrade theoretical knowledge. For them, vocational training which would associate the acquisition of technical-scientific concepts to the acquisition of practical abilities represents a major challenge. It is in order to meet this challenge that we have given ourselves the research objectives which follow.

RESEARCH OBJECTIVES

The ultimate objective of our work is oriented towards analysing the appropriation process of technical-scientific knowledge and practical knowledge in the students who postulate a vocational training diploma in a given trade or technique. In this work, we will describe the main elements of the appropriation process of both these types of knowledge. We will systematically distinguish between the modalities of appropriation of technical-scientific concepts, as opposed to those of practical abilities. The scope of this analysis covers all of the vocational training period in school plus the first year on the labour market, i.e. approximately three years.

This general objective can be specified as follows: **1)** identify, describe and analyse the level of appropriation (command of the knowledge being taught) attained, and the process of appropriation (phases, ways and means) of both technical-scientific concepts and practical abilities; **2)** describe, evaluate and analyse the level and the type of association, of "lag", or "break-off" that can be observed between the appropriation of technical-scientific concepts and that of practical abilities; **3)** analyse the factors which bear influence appropriation of technical-scientific concepts and practical abilities. Among the various appropriation factors possible, we will focus particular attention on : the training program, the agent responsible for transmitting knowledge (teacher, foreman, etc...), and ,finally the relationship between this agent and the student.

THEORETICAL FRAMEWORK

The theoretical framework within which we have elected to work, is comprised of two general dimensions, each based on a specific field of discipline, namely that of cognitive psychology, and that of sociology of education. Before specifying these two dimensions, we will first define the major concepts already used in specifying our research objectives.

Definition of concepts:

We will presently define the following terms: technical-scientific concepts, appropriation, appropriation process, appropriation phases, appropriation level, association, "lag" ("décalage"), "break-off" ("rupture"), training program, and finally, training agent.

TECHNICAL-SCIENTIFIC CONCEPTS: Scientific concepts and principles which form the base of technology and which open unto a better understanding of the foundings of technical knowledge and unto practical abilities.

APPROPRIATION: conceptual and operational command of a given knowledge such that the person who has acquired this knowledge is capable of applying it in situations more or less different from those in which the knowledge was transmitted.

APPROPRIATION PROCESS: succession and structure of the set of events and conditions which, during each phase of appropriation of knowlekge, lead each person and group of persons to a specific and progressive level of conceptual and operational appropriation of knowledge.

APPROPRIATION PHASES: periods of time which divide the appropriation process into significant units of measure and analysis, in order to caracterise the evolution of the appropriation process of knowledge.

APPROPRIATION LEVEL: Degree of conceptual and operational command of knowledge, evaluated both in extension (extent of knowledge) and in comprehension (degree of difficulty of the given knowledge) vis-à-vis the knowledge proposed within the training program, and that transmitted by the training agents.

ASSOCIATION: congruence between the appropriation level of the technical-scientific concepts and that of practical abilities at each phase of the appropriation processs.

"LAG": gap between the appropriation level of technical-scientific concepts and that of practical abilities at each phase of the appropriation process.

"BREAK-OFF": absence of progression or stagnation of the appropriation level of technical-scientific concepts simultaneous with progress in the appropriation level of practical abilities at each phase of the appropriation process.

TRAINING PROGRAM: Structured set of training objectives and learning content, and pertinent teaching and evaluation strategies, as presented in the study program approved by the Department of Education and in the training material (textbooks, teaching software, other software, etc...) approved by regional education boards and/or used by teachers in their class.

TRAINING AGENT: in school, the teacher who guides the student in his training process within class, within school-workshop, or during a practical training period; in the working environment, the person (foreman, instructor,...) who guides the student, now apprentice, in his adaptation to the function, and his implication within the organisation as a whole

The cognitive dimension

Cognitive psychology is used to circumscribe the modalities of transmission of knowledge by the training agent and the modalities of appropriation of the knowledge by the student.

To be more specific, this dimension enables us to circumscribe the following:

- the cognitive disposition of students, at the start of their vocational training

- the learning style of the students, and that of the training agents who are responsible for them;

- the evolution of the representations of students and training agents relative to knowledge;

- the appropriation level of technical-scientific knowledge and practical abilities actually attained by each student at each phase of the appropriation process of professionnal knowledge;

- association, lag or break-off between appropriation of technical-scientific concepts and practical abilities, as can be observed in each student at each phase of appropriation of professionnal knowledge;

- the teaching strategies implemented by the training agents relative to the students;

- and, finally, the cognitive modes of organizing technical-scientific and practical knowledge prevalent in the training programs and didactic material.

The second dimension is sociological and is developped hereafter.

The sociological dimension

Sociology of education allows us to examine the process of professional socialisation at work within the appropriation process of professionnal knowledge. Professionnal socialisation is defined here as the continuous process of building the professionnal identity of the student which process results from interaction between the student and his environment (school, family, friends and working environment).

Professionnal socialisation bears on social rules, values and behaviours sought and adopted, or else avoided and rejected by the student in order to draw near the professionnal model which guides him in constructing this identity. It influences appropriation of professionnal knowledge just as much as the professionnal perceptions and professionnal practices

To be more specific, the sociological dimension allows us to analyse:

- the social modes of organizing the dominant technical-sientific and practical knowledge elements within training programs and corresponding didactic material

- the professionnal socialisation mode proposed to the student by the training program

- the evolution of the socialisation mode proposed by the training agents, first in school, then in the working environment

- the evolution of the socialisation process in which the student is effectively engaged, during and after his school training vis-à-vis the socialisation process proposed to him by the training agents;

- the links between the appropriation level of technical-scientific concepts and practical abilities on the one hand, and the socialisation process experienced by each student during each phase of the appropriation process of professionnal knowledge., on the other hand.

Combining cognitive and sociological dimensions should lead us to a relatively complete analysis of the appropriation process of professionnal knowledge in vocational high-school students. Broad lines of the project's methodology are developped hereafter.

METHODOLOGY

This longitudinal research will be based on data gathered during a period of approximately three years. During the first two years, the work will be performed in school, while the vocational training program is being given. The work of the third year, will be performed within the working environment where the former students have been hired.

Our observation ground will be comprised of at least two professionnal training profiles, one being essentially composed of girls the other of boys This is justified by the sexual polarization of the labour market and vocational hihg-school training profiles The training profiles to be selected must lead to employment sectors which are not saturated, so that the students observed have a reasonable probability of finding employment within their sphere of training. Secretarial training seems a likely candidate sector for girls; machine shop training or electro-mechanical techniques seem probable for boys. In each profile, we will select two cohorts regrouping all students of a given class i.e. some twenty students. The total sample should then number some eighty (80) students.

We will analyse the content of the training programs in effect as well as that of the training material used by the teachers in each of the profiles selected. Our investigation will bear on all training agents and all students of each of the four cohorts.

As far as instruments of measure and analysis are concerned, our present thinking leads us towards the following:

- content analysis grids,: for training programs, training material, lesson preperation and examinations;

- the report card of the year previous to entry in vocational training, accompanied by tests relative to mathematical reasoning and text understanding, in order to measure the cognitive dispositions of each student at the beginning of vocational training;

- tests on the learning style of students as well as on the learning style of the training agents

- tests measuring the appropriation level of both technical-scientific concepts and practical abilities at the end of each phase of the appropriation process in school and in the working environement

- interviews with the students at the beginning of vocational training, at the end of each phase of the appropriation process within school, and then in their working environment;

- interviews with the training agents involved at the end of each phase of the appropriation process in school and in the working environment;

ORIENTATION OF THE WORKSHOP

The orientation that we wish to give the ensuing workshop bear on operationalization of the theoretical framework and development of the methodology.

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AN EXPERIMENTAL STUDY OF INCORPORATING CREATIVE AND INVENTIVE CONCEPTS INTO VOCATION HIGH SCHOOL CURRICULA

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The purposes of the study were (1) to explore the influence of creative-thinking curriculum for the ability of creativity and invention in Voc-tec students; and (2) to design an appropriate creative-thinking curriculum (C TC), to be used as the basis for the dissemination of creative instruction in the Voc-tec schools.

The major findings of this study are as follows: (1) The mechanics-experimental group scored significantly higher than the mechanics-control group on figural, Torrance Test of Creative Thinking (TTC T). (2) The mechanics-experimental group obtained significantly higher scores on TTC T, verbal fluency and flexibility than the mechanics-control group, while the electronics-experimental group did significantly better than the electronics-control group on verbal fluency. (3) In light of Williams' Creative Assessment Packet; significant differences were obtained between mechanics-experimental and mechanics-control group. (4) No significant difference was found on the scores of Inventire & Design Ability Test (IDAT) between the experimental and control group. (5) The samples in electronics group scored significantly higher than the mechanics group on figural-fluency. (6) There is positive correlation among all students' IDAT, originality, useful, elaboration to the Figural-elabortion. (7) Most of the students enjoy C TC and consider it would enhance their creative and invention ability.

The history of human civilization is nothing but the history of creativity. Civilization of mankind is the product of creativity. Every man possesses the power of creativity (Wiles 1985), and this is the quality uniquely possessed by human beings. As the famous historian, Toynbee implied that a society or nation lacking the power of creativity will never be able to face the future struggles and encounters nor worldly problems. Creative problem-Solving skill is man's most important fundamental adaptive ability (Torrance, 1972).

Research and training of creativity have already gained recognition and importance recently. After the speech delivered by Guilford on creativity in 1950 at the Annual Conference of Psychology in America, researches on "Creative Psychology" has gained recognition in the world of psychology and education (Gilchrist, 1972), from 1950 to 1964, there were as many as 4, 176 papers written on "creativity" or "creative skill" (Chien, 1982). From 1984 to 1987 the 'Dissertation Abstracts International' covered a total of 120 doctorate thesis on "creative skill". Torrance (1973) conducted a survey and analysis on 142 researches of creative-skill training, and found that 72% of the training proved to be effective in enhancing the creativity skill. Chen (1984) collected 50 reports on the study of creative skill training conducted abroad, out of which 86% was effective or partially effective, thus demonstrates that the success-rate of creative-skill training was quite profitable. It is a widely receguised fact that the development of creative skill can be brought about through appropriate education and training procedures (Daid, 1982).

Technically, creative potential implies invention, and invention is the very basis for technical pregress. From the early years, America has always encouraged and protected the right of invention by laying down laws in the state.

As to the worldly important inventions, there were 210 inventions through the 19th century. Among them, American inventions accounted for 53 of them. From 1900 to 1966, 48 out of 160 inventions were made by Americans. On the event of Centenary Celebration of Edison's Invention of the electric Bulb, the head of the "Patent and Trade Marks" department of

America mentioned that according to estimates from 1929 to 1969, 45% of the growth of American economy was due to the achievements of technical progress. In fact, a glance at the products of civilization around us: cars, aeroplanes, telephones, televisions, washing-machines, refrigerators, etc., shows that not a single thing was not invented by the Americans.

From 1885, Japan has started to imitate America in adopting the "Patent" policy, actively promote and ecourage inventions. In the entire 41 counties, there are a total of 91 "Young Men & Young Women Invention Classrooms". In 1984, Japan's "Patent" applications accounted for 44% of the whole world's 1110 thousand applications (Japan Patent Office, 1987). Industrial development of Japan which has caught world-wide attention is in fact the efforts of inventions. As Koizumil stated in 1982: "Japan now has a sizable advantage in overall technology over the United States" (Lewis, 1986).

Republic of Korea conducted a study on the reasons for Japan's industrial development, this study revealed that it was all due to promotion of inventions, hence from 1982 it started actively promoting inventions. The president of R.O.K. gave order to establish the students invention activity class in the entire nations, including middle, high schools and universities and allow the governmental organization to provide the necessary assistance and guidance to the students of each class. The "Patent" applications made by Korea showed a remarkable increase from 7.9% in 1983 to 35% in 1984 (Kang, 1986).

Promotion of invention is the primary cause of industrial development, the main claim of industrial art or technology education is to enhance the technological achievement skills and technological problem-solving skills of students. Zaner (1987) has said the argument that the creative problem-solving skill is far more important than specific facts and tool skills is very persuasive and has much merit.

The research on promotion of creative potential carried out in industrial education classes has gained definite positive results. Wey (1985) conducted a research on the students of the Appalachian University from the photography, metal-working and electronics departments, he provided the students with a guide book on creative problem solving skill written by himself, and discovered that within the industrial education classes, student's creative skills could be enhanced and developed. Horton (1986) employed three different activities: mindstorming, sketch storming and model storming on the 12th grade high school students, to evaluate the effectiveness of creativity on industrial technology designing, and discovered that the creativity activities have improved much of the students' topic creativing ability.

Most researchers agree that, "the development of creative problem-solving skills has been considered a major objective for industrial education programs" (Lolla & Miller, 1980), yet several research studies derived the same result, "Although the existing research on the development of creativity in industrial arts programs is encouraging, little such instruction actually occurs". Sommers (1965) has speculated that one of the reasons why creativity is not taught in these classes is that the instructors do not themselves have the necessary knowledge (Wey, 1985).

Therefore, the most important topic in today's industrial technology education is to establish the pattern in which industrial education can encompass creative thinking abilities.

An industrial education student who can exercise his creativity on the technological level, possess technological innovation skill and technologically creative problem solving skill, will be able to enhance the fruits of industrial education. In "The process of education", Bruner (1960) made a famous hypothesis: "Any subject can be taught effectively in some intellectually honest form to any child at any stage of development"; this hypothesis has already been proved true. Motive is the driving power of learning, creative thinking and creative problem solving skill require proper teaching methods in order to produce & cultivate them.

Researches on creativety in our country are at present being actively extended, most of them are focused on the general courses in primary and secondary schools, as to the domain of industrial education, we are still in the enlightenment stage. The culture of our nation has always adopted a rather conservative attitude, customary style of education and the pressures of entrance examinations, all have a trend in suppresing the development of creativity. The present matter of utmost importance is the establishment of an appropriate "Creative thinking teaching material" for the students of industrial technological education in our country.

The aim of this research is to design and implement a practical and experimental course in "Creative thinking & invention" for Voc-tec students, the following are the points of discussion:

1. Will this course enhance the student's creative thinking skill?
2. Will this course enhance the creativity and invention ability of students?
3. Do invention ability and creative thinking skill exist any correlation?
4. Is there a difference in the enhancement of creative thinking and invention ability between the students of mechanics and electronics?

METHOD

Subjects

The subject in this study was a random selection of experimental and control groups from the mechanics and electronics students of Taipei Soong-Sang Voc-tec School. Number of students in each group was: Mechanics experimental group: 45, control group: 44; electronics experimental group: 43; control group: 44.

Instruments

1. Army General Classification Test (AGCT)
   This test was an edition of the English version, under the guidance of two professors of our country, Prof. Hwang Chien-Hao, and Prof. Loo Chuin-Wue.
2. Torrance Tests of Creative Thinking (TTCT)
   This test includes two different figural forms A & B, verbal forms A & B, employed in pre and post-test revised by Dr. Wu Ching-Chi, Dr. Liu Ing-Mao, Mr. Chen Lung-An separately. The figural forms have three topics and verbal forms have seven. The present research adopted the third topic of the figural forms: "Parallel lines and Circles", and the fourth topic of the verbal form "Unusual uses".
3. William's Creative Assessment Packet (CAP)
   This test was revised by Dr. Lin Shing-Tai and Dr. Wang Chai-Rung from our country.
4. Inventive & Design Ability Test (IDAT)
   TTCT & CAP can measure the creative thinking skill & the invention ability in order to evaluate the inventive ability of the students, the researchers designed the IDAT according to the testing procedures. For the mechanics group: it included the correction of the chair. For the electronics group was the creative composition of electronic parts. On account of the limit of man power and other restrictions, the reliability and the validity of the test were not established, the scorer reliability has proved to be effective.
5. Experiment Materials:
   The main topics of the experimental course were creative thinking and invention skills, which contain 9 teaching units: (1) The introduction and examples of invention, (2) Invention method-(I), (3) Brainstorming, (4) Invention method-(II), (5) Creative essay contest in small groups, (6) Creative thinking, procedure-designing and the analysis of worth, (7) Patent rights, (8) Observation skill and imagination skill, (9) Literal thinking.

Experimental Design and Treatment

This study was the Pre-post test control group experimental design, the table of experiment design is as follows:

Table 1 Experimental Design

Group	Pretest	Treatment	Post-test
Experimental Group	T_1	X	T_2
Control Group	T_3		T_4

The experimental group had a nine-week, two hours per week's instructional program, with 9 units of teaching materials, one unit per week. The subjects completed the TTCT, Figural Form A, verbal Form B, CAP and IDAT before the treatment, and the TTCT, Figural Form B, CAP and IDAT after the treatment. Further, AGCT was carried out before the instruction to be a covariance.

Analysis of Data

1. A 2x2 analysis of variance (ANOVA) with repeated measure was used to investigate the influence of experimental curriculum to the inventive skill of Voc-tec students the data of mechanics and electronics students were analyzed separately, of which group variable was the independent variable, and the pre-postest scores were treated as the independent variable, with the AGCT as the covariate. If there was the significant difference between the group and the pre-posetest, then adjusted means was be used to test the simple effect.
2. A linear product-moment correlation matrix was used to indicate the relationship between the invention ability and creative thinking ability, i.e., the innovation, practicability and elaboration in the invention ability dimenion; the fluency, flexibility, originality and elaboration in figural dimension; and the risk of creativity, curiosity, imagination, and challenge in creative tendency.
3. A 2x2x2 three factor covariance analysis with repeated measure was used to investigate the difference between the mechanics and electronics in the increase of creative thinking and inventive ability, of which group and subjects were independent variables and pre-postest scores were dependent variables, AGCT was the covariate.

RESULTS

The Effects of the Experimental Curricula on the Creative Thinking, Creative Tendencies and Invention Ability of Mechanics Students

From table 2, we can see that the mechanics experimental group scored significantly higher than the mechanics control group on figural fluency, flexibility, originality, elaboration verbal fluency and flexibility, on the other hand, the control group scored higher than the experimental group on creative tendencies and imagination. There was no marked difference between two groups on verbal originality, risks in creative tendencies curiosity, invention designing and innovation, practicality, and elaboration.

The Effect of the Experiment Curricula on the Creative Thinking, Creative Tendencies and Invention Ability of Electronics Students

From table 2, we notice that the electronics-experimental group was better than the electronics-control group in figural elaboration, flexibility, originality & verbal fluency, but the control group was better than the experimental group in invention designing accuracy. There was not a marked difference in two group in 9 areas; figural elaboration, verbal flexibility, originality, creative tendency risks, curiosity, imagination, challenge, invention designing innovation and practicality.

Table 2 The Effect of "Creative Thinking and Invention" Curricula

Item / factor / sig. diff. / source of variance / subjecty		figuran, TTCT				verbal, TTCT			CAP				IDAT		
		flunency	flexibility	originality	elaboration	flunency	flexibility	originality	risk	curiosity	imagination	challenge	originality	useful	elaboration
mechanics group	Group (A) (EG,CG)	**	**	**	**			**			**		*	*	**
	pre–postest (B)		*	*	**		**	**			*		**		
	A x B	**	*	**	*	**	**								
	Simple Effect	C.B>E.B C.A>E.A	C.B>C.A C.B>E.B C.A>E.A	C.B>C.A C.B>E.A	E.B>E.A C.B>C.A C.B>E.B	E.A>E.B C.B>C.A E.A>C.A	C.B>C.A				C.A>C.B				
electronics group	Group (A) (EG,CG)														
	Pre–Postest (B)	**	**	**	**	**	**	**					**	**	**
	A x B	**	**	**		*									**
	Simple Effect	E.A>E.B E.A>C.A	E.A>E.B E.A>C.A	E.A>E.B E.A>C.A		E.A>E.B									C.A>C.B C.A>E.A

* P>.05 ;   * * P>.01   E: experimontal group   C: control group   B: pretest   A: post-test   >: significantly better

The Relation Between the Results of Invention Designing Skill and Creative Thinking Skill

From the results of the various invention designing tests before instruction and figural and verbal creative thinking, creative tendencies we can obtaine the data needed. Table (3) indicates the results of mechanics and electronics students which reached α = .05.

Table 3 Relation between the invention designing ability scores and creative thinking ability scores

subjecty		I D A T		
		originality	useful	elaboration
Mechanics	Figural-elaboration	.2164*	.3055**	.1859*
	Curiosity of CAP		.1995*	
	Imagination of CAP		.2087*	.3302**
Electronic	Figural-elaboration	.1945*		

* P < .05 **P < .01

From table 3 we observe that there is little creative thinking ability which has any positive relation with invention designing ability, except the figural-elaboration.

The Difference between the Enhancement of Creative Thinking and Invention Designing Skills in Mechanics and Electronics Students

The present study uses 2x2x2 three factor covariance analysis, investigating whether there is any difference in the scores on figural, verbal creative thinking ability and creative tendencies of the student's from the two subjects. The findings were that there was only a significant interaction in figural fluency.

The adjusted average scores of the two groups before & after instructions were as follows: Mechanics experimental group: 14.5–15.65; control group: 20.80–19.30; electronics experimental group: 18.99–24.11; control group: 16.76–16.86, from the adjusted means we can see that the electronics student scored significantly higher than the mechanics students on figural fluency.

Table 4 The analysis of covariance table in mechanics and electronics students on "Figural fluency" score

Source of variance	SS	df	MS	F
A (Group)	145.83	1	145.83	2.94
B (Class)	89.01	1	89.01	1.79
A x B	749.66	1	749.66	15.11**
Subj. W. groups	7,986.60	161	49.61	
C (pre-postest)	242.58	1	242.58	15.74**
C x A	604.42	1	604.42	39.22**
C x B	325.82	1	325.82	21.14**
C x A x B	59.41	1	59.41	3.85*
Subj. W. groups x C	2,496.79	162	15.41	

* P < 0.05 ** P < 0.01

DISCUSSION

Effect of Experimental Course on Creative Thinking Skill

The creative thinking ability indicated in the present study is the score of figural, verbal creative thinking.

From table 2 we observe that experimental course can enhance figural, verbal creative thinking skills of mechanics and electronics students, this has been largely supported by the present research. Results of studies on creative thinking courses at our country and abroad are quite the same (Wey, 1985; Chen, 1984).

Effect of the Experimental Course on the Creative Tendencies and Invention Designing Skills

From table 2 we observe that except for the case of mechanics-control group scoring significantly higher than the experimental group in "imagination", the other scores on creative tendencies do not show a marked difference, in fact, mechanics-experimental group's average scores were 27.86–28.23 in the tests taken before & after instructions, that of the countrols were 26.00–27.83, we can assume that the slight difference is due to chance. The present study's experimental course could not enhance the creative tendencies scores, this result agrees with that of the experiment conducted on 11th grade students by Lee (1987) but the result does not agree with that of the experiment conducted on primary school students by Lin (1984) & Hung (1986), this disagreement may be due to the factor of age, the older the subjects, the more rigid of the creative tendencies, therefore not easily subject to change, hence a period as short as 9 weeks instructions could not improve the creative tendencies.

From table 2, we observe that except for the case of electronics control group scoring significantly higher than the experimental group in "elaboration", the other results of the IDAT showed no marked difference, this may be due to the short period of experimental instruction and the similarity of examination paper before and after experimental instruction lessened the motivation among the students to answer once again the same questions, and the electronics-control group's scores being significantly higher than that of the experimental group in the IDAT accuracy test may be due to the interference of teachers outside the experimental instruction course.

Though the experimental group did not show a significant improvement in the IDAT results, yet from the daily Idea Projects and revision papers at the end of the semester we can observe that this course did have a positive contribution to the structural designing of the students, most students were quite willing to undertake this course.

Relation between the Invention Designing Skill and Creative Thinking Skill among the Creative Tendencies

From table 3 we observe that the scores on creative thinking skill and creative tendencies have little relation with the scores on invention designing ability, this results quite agrees with that of Horton's (1986). According to Horton, there is no important relation between the scores obtained by Torrance Figural Form B and the designing of main topic creative essays.

Scores on figural elaboration indicate embellishing skill of the students, and invention designing depends on the concentration of minute details, hence invention designing skill is directly related to figural elaboration, this conclusion is quite reasonable.

Effect of Different Subjects on the Enhancement of Creative Thinking Skill

The electronics group showed a more significant improvement in figural fluency than the mechanics students. This result agrees with that of the study by Lee (1987), this may be due to the three semesters of "Engineering Graphc" which the mechanics students have to take, thus producing "function fixed" effect, leading to the inability of mechanics students coping up with the electronics students in the enhancement of figural fluency.

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TEACHING AND LEARNING IN TAFE: DOES TAFE SELL ITS STUDENTS SHORT?

Keith Gove, VCAB/TAFE Liaison Officer
Victorian Curriculum and Assessment Board

Many commentators have suggested that we are in changing times, moving from one technological paradigm to another,

> "... from a paradigm based on mass production, mass consumption and fragmentation of skills, termed Fordism, to a paradigm based on flexible production patterns, quality rather than quantity, and skill enhancement as the basis of productive work" (Mathews et al 1987 p3).

However, there have been few suggestions about how to alter educational practice to cope with these changes.

In this paper I will outline some recent thinking about teaching and learning which highlights the factors that contribute to improved student learning, and explain why and how TAFE curriculum needs to change to accommodate these ideas. In doing so I will look briefly at the new Victorian Certificate of Education. I will relate these ideas to our western cultural context which tends to separate theory from practice and management from operations, according higher status to those who deal with theory.

Deep and Surface Approaches to Learning

The way that students' approach their learning can be viewed within two dichotomies. One dichotomy is between deep and surface approaches to what they learn - whether they search for meaning or not. The second dichotomy is between holistic and atomistic approaches to how they learn - how they organize their learning (Marton et al 1984). There are differences between the two dichotomies (Entwistle and Ramsden 1983), but for the purpose of this paper, I will refer to a single dichotomy, deep versus surface.

With a deep/holistic approach, students aim to understand the meaning of what they are learning; they relate the ideas to their own experience and previous knowledge; they try to make judgements about the worth of the material; and they treat the material as a whole - trying to see the relationships between the parts, and their relationship to the overall aim or concept or material.

Alternatively, with a surface/atomistic approach students focus on the facts or details, try to memorize the material being studied, guided usually by what they think will be assessed, with an aim to reproduce rather than understand; they focus on specific examples and material in sequence, without relating it to a "big picture".

Deep/holistic approaches to learning are much more effective than surface/atomistic approaches. For example, with a group of 30 first-year tertiary students, of the 16 who tended to use a holistic approach to studying, 13 passed all examinations, compared with only 4 of the 14 who tended to use an atomistic approach (Svensson 1977);

> "... a firm hold on detail and a facility with principles can only be achieved by using a deep approach" (Beswick and Ramsden 1987).

Many learning environments do not encourage deep/holistic approaches to learning (Ramsden et al 1987), despite the fact that many educators would describe "good education" as in fact deep and holistic.

It is important to note that students are not inherently "deep" or "surface" in their approaches to learning, nor do they consistently use the same approach - they use an approach which is perceived by them to be appropriate for the situation.

Factors which influence students' approaches to learning

The factors which influence students' approaches to learning include: the structure of a course, assessment, extent of choice over how and what is learnt, and the extent to which teachers focus on students' cognitive processes (Entwistle and Ramsden 1983).

Courses which are structured with an emphasis on many details, tend to encourage surface approaches; conversely, courses structured with an emphasis on a smaller number of main concepts, and the relationship of subject detail to these concepts, are more likely to encourage deep approaches.

Assessment which focuses on regurgitation of facts, or the placing of values into formulae, encourages surface approaches; deep approaches are encouraged by assessment which tests real understanding of the main concepts. Students often pursue further study with misunderstandings of basic concepts (eg the concepts of "price" in economics, "acceleration" in physics), because their assessment has concentrated only on facts and not with students' real understandings (and misunderstandings) of basic concepts (Masters 1987).

Similarly, deep approaches are encouraged by teaching which focuses on how students make sense of the material they are learning. If the focus is not students' real understandings (that is, the picture they hold in their head), then not only might students get it wrong in the long run, but there is the risk that students will divorce their "learning" from their commonsense view of the world - theory and practice will remain separated.

Student choice over ways of learning and content also contributes to deep approaches (Beswick and Ramsden 1987).

Should TAFE be "deep"?

It seems appropriate at this stage to address an objection which is often raised - does "vocational education" warrant deep approaches to learning? If students are simply learning skills or knowledge for a particular job, do they need to "understand" things in the same way that students with a more generalist orientation do? I believe yes, for several reasons.

One reason is that vocational education is these days not just skills acquisition (if in fact it ever was). Seventy percent of the Victorian state training system deals with other than apprentice-type programs - middle level, paraprofessional, preparatory and further education in a broad range of fields (State Training Board 1988). Even apprentice-type programs are moving away from one-off skills acquisition (Deveson 1988). That is, vocational education is at least partly concerned with students' understanding of concepts and principles behind the skills and knowledge they are acquiring.

A second and related reason is that there is an increasing demand by employers and industry for workers who are able to make judgements, solve problems, communicate, (Mathews et al 1987, Naisbitt 1985). Such qualities are difficult to foster if vocational education merely focuses on skill acquisition (practice) without a base of good understanding (theory).

Finally, a moral reason in addition to the economic reasons mentioned, is that TAFE students ought to have the opportunity to develop a theoretical underpinning to their vocational skills, to empower them in the workplace, to enable employees to be more what Cooley (1980) calls "architects" (implying some control over the work task) rather than "bees" (implying mere dronelike working). This is one way that the traditional status and power differentials between "thinkers" and "doers" might be reduced.

So, this paper continues on the assumption that it is desirable for TAFE students to understand to some extent the concepts and principles which underpin their vocational skills and knowledge.

Deep and Surface Approaches to Learning in TAFE

To what extent does the teaching and learning environment in TAFE encourage students to take a deep approach to learning?

TAFE courses generally consist of a large number of performance objectives translated into classroom activities via enabling objectives; students are assessed on their achievement of the performance objectives (TAFE Board 1984, Mager and Beach 1967). This has tended to result in TAFE course descriptions which are very strong on details, but light on integration of this material. This is one factor which often encourages students to take surface approaches to learning.

Assessment in TAFE often reinforces this emphasis on the acquisition of facts and skills rather than a fuller understanding of the subject. TAFE assessment often asks students to "identify", "describe", "list", and so on, which students can do without necessarily understanding the underlying principles of the topic.

The highly structured nature of many TAFE courses makes it difficult for students to have much choice about what and how they learn. Lack of choice is seen to encourage surface approaches to learning (Entwistle and Ramsden 1983 p118).

Some suggestions for TAFE

What does this mean for TAFE courses? In a general way, the following should guide curriculum design in TAFE.

The main ideas or concepts in a course should be focused on, emphasising the interrelationships between these ideas, and the relationships between them and specific subject details.

TAFE assessment should similarly reflect a greater emphasis on students' real understanding of main ideas, not just their factual recall of subject details.

Where possible, students should be given choices about what and how they learn. This implies giving greater flexibility to students and less pressure than is currently the case. Teaching more (content) can mean teaching less (meaning).

Finally, the role of TAFE teachers should be seen as one of facilitating student understanding, rather than one of imparting a detailed body of knowledge. For example, focusing on the processes by which students arrive at answers and inferring the causes of students' misunderstandings, rather than simply judging them right or wrong.

It is easy to make general suggestions. One particular example of a curriculum change which attempts to incorporate these ideas is the new Victorian Certificate of Education (VCE).

The Victorian Certificate of Education

How might courses which encourage deep approaches to learning be designed?

Victoria is reviewing its senior secondary curriculum. The development of the new VCE is one outcome of this. The VCE is being designed within what is called the study structure approach. The centrally accredited curriculum document is called a study design. All year 11 and 12 subjects are being designed within forty-four study designs, grouped into fourteen fields of study for administrative purposes (VCAB 1987).

Study designs consist of four components, as well as broad aims and objectives: areas of study, work requirements, common assessment tasks (CATs), and course development support material (CDSM).

Areas of study describe the important areas of learning in the study, usually in three to six major sections.

Work requirements are activities (such as laboratory work, essays, research, folios, practical activities) which students undertake in order to learn about the areas of study. There are normally three to six work requirements per semester unit, and each must be satisfactorily completed for a student to gain their VCE. Work requirements are assessed satisfactory (S) or unsatisfactory (N).

Because the community requires an assessment grading finer than the two points S and N, CATs will be used to provide a five-point (A - E) externally verified grading. There will be four assessment tasks per study, each CAT assessing a distinct major area of learning in the study. The CATs will, like work requirements, cover a variety of tasks (such as essays, research, practical work); only one or two of the assessment tasks in each study will be traditional tests. The student's certificate will report the nature of the CAT, the grade gained (A - E) and a description of the level of ability implied by the grade. With four of these descriptions per study, and a likely five study completion, the certificate will provide a fairly comprehensive profile of the student's academic strengths and weaknesses.

The main change in the VCE from traditional courses is that content is not specified as a series of unrelated chunks of knowledge. By identifying a small number of major areas of study, and requiring students to integrate these through a number of work requirements, students are strongly encouraged to see their learning in a holistic way - that is, to take a deep approach to their learning. The assessment reinforces this by assessing whole tasks (for example, a research project), not just recall or formula filling.

Also, the study designs aim to provide a balance of theory and practice. Traditional practical subjects (such as woodwork, textiles) have a theoretical basis, and traditional theoretical subjects (such as physics, history) have a practical component.

The fourth component of the study design, CDSM, is needed because the study design is a broad framework within which providers can design their own courses, so there is a need for teacher support materials to assist teachers in the process of course design.

The new VCE shows one way to devise curriculum to encourage students to take deep approaches to their learning. It may be useful to examine when modifying curriculum and teaching in TAFE.

As a part of the review of senior secondary curriculum, the state training system is also looking at ways to achieve articulation with the VCE. There are several projects currently underway (Outer East College of TAFE, Frankston College of TAFE) which show some promise in terms of credit transfer between the VCE and TAFE courses. One of the useful outcomes of this work is the possible restructuring of TAFE curriculum documents to present the material in more holistic ways by, for instance, grouping together what were previously dozens of individual performance objectives under more coherent areas of study and work requirements. In other words, TAFE teachers would be encouraged to present their material in a more integrated, holistic manner, encouraging students to take a deep approach to their learning.

Another example of creating a learning environment which encourages deep approaches to learning is given by Eizenberg's (1986) report on modifying an anatomy course.

Conclusion

Our society unequally distributes status, power and resources based largely on occupation: thinkers are given greater rewards than doers. TAFE has traditionally catered for those who deal with the practical (doers).

I have touched on some assumptions that exist about learning about the practical, best summed up in the word "training" - the consequence of which is to encourage a surface approach to learning. What I am suggesting is that for the benefit of the individual and the community, vocational education must be just that - educative. It should encourage students to seek deeper understandings of the skills and knowledge which they are learning.

By not providing TAFE students with an environment which encourages deep approaches to learning, we risk reinforcing the lower expectations often held of those who deal with the practical. If the TAFE environment encourages surface approaches to learning, then we deny students access to fuller understandings of their subjects; and they may remain unable to contribute fully to their working environment. We also prevent TAFE students developing the capacities which our industries need for full economic growth.

The paradigm shift mentioned at the beginning of this article provides TAFE with the opportunity to make significant changes in its curriculum. It should take this chance to improve the opportunities for real learning which it provides to its students.

Keith Gove
December 1988

Biographical Data

Keith Gove has spent several years in industry and taught for ten years in the Victorian TAFE system, four years of which have been at middle and senior management level. He is currently seconded to the Victorian Curriculum and Assessment Board where he is the VCAB/TAFE Liaison Officer.

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The views expressed in this paper are not necessarily those of VCAB or the Victorian State Training Board.

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WORKSHOP B

Theme: Performance Assessment.

Monday March 13. 11.30 am; Friday March 17. 11.00 am.

Adelaide Room 2

Professor A.G. Smithers. Department of Education, University of Manchester, United Kingdom. *Vocational Qualification and Access to Higher Education.*

Ms. G.A. Holdgate. Senior Research Officer, Education Testing Centre, University of New South Wales. *Competency Tests: Their role in selection of apprentices and trainee technical officers in Australia.*

Dr. B.E. Hinton. Project Director, Department of Vocational Education, University of Arkansas, Fayetteville, Arkansas, USA. *Development and Analysis of a Criterion-referenced Item Bank.*

Professor Merle E. Strong. Vocational Studies Centre, University of Wisconsin - Madison, USA. *Follow-up Studies of Graduates Using State Data Bases.*

Mr. Hugh Guthrie. Senior Research and Development Officer, TAFE National Centre for Research and Development. *Whither Performance Indicators in Vocational Education?*

VOCATIONAL QUALIFICATION AND ACCESS TO HIGHER EDUCATION

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In its White Paper, Higher Education: Meeting the Challenge (Cmnd. 114, April, 1987) the British Government recognises three routes into higher education: (i) traditional sixth form qualifications like A levels and Scottish Highers; (ii) vocational qualifications; and (iii) access courses for mature students. A growing number of students entering on the basis of vocational qualifications is envisaged.

In an earlier White Paper, Working Together - Education and Training (Cmnd. 9823, July, 1986), the Government accepted the recommendations of the Review of Vocational Qualifications and went on to set up a National Council for Vocational Qualifications. Among the priorities identified was the "need to bridge the unhelpful divide between the so-called 'academic' and the so-called 'vocational' qualification".

The National Council's primary task has been to reform and rationalise the provision of vocational qualifications through the creation of a National Vocational Qualification Framework. Within this, the awards of approved bodies are to be accredited on a common scale at different levels. A major consideration for the framework has been to provide clear routes of progression to higher qualifications including those based on degrees. It is intended therefore that NVQs will not only be statements of work-related competence, but, at appropriate levels, be a means of entry to, and progress within, higher education and higher level professional qualifications.

NVQ FRAMEWORK

Within the NVQ framework candidates receive accreditation by an approved body when they can successfully demonstrate in applied contexts the skills, knowledge and understanding appropriate to the level at which they are being assessed. Competence at a specified level may meet the needs of particular employment, but the requirements at any level are intended to be sufficiently comprehensive to be a basis for progression to a higher level. The framework is designed in such a way that the development of individual potential, including personal and social skills, is encouraged. Progression through the different levels need not be consecutive.

At present, the NVQ framework has four levels, but the Council has been invited by the Government to consult with appropriate professions and other bodies as to how degree and postgraduate awards can be brought into the same scheme and it is likely that one or two additional levels will be added.

LEVEL I. Basic Level.

Qualifications at this level should accommodate both those that match a minimum job requirement and those designated as an entry to employment from programmes such as the Youth Training Scheme.

LEVEL II. Standard Level.

Qualifications at this level will be awarded for competences needed for many occupations whose requirements are significant but which are primarily of a routine and predictable character.

LEVEL III. Advanced Level.

Qualifications at this level will be awarded for competences needed for occupations which are not of a routine character, and which may require application in a variety of contexts and roles. The skills achieved at this level may be of such a nature as to indicate capability in supervisory and junior management roles, or to progress into advanced further education and training.

LEVEL IV. Higher Level.

Qualifications at this level will be awarded for competences needed for occupations with specialist or supervisory or professional requirements and which need the capacity to adapt to major job role changes while maintaining full accountability and responsibility for personal outputs and those of others. The minimum standards of qualifications at this level will be appropriate to complex, specialist and supervisory functions and for those occupations where education and training needs are presently met by Higher National awards plus, where appropriate, additional skills, understanding and ability in application needed for the trainee to be regarded as competent.

Beyond LEVEL IV.

If the NVQ framework is to be extended to include degree and postgraduate professional awards, it is probable that a further two levels will be added. The Council is currently engaged in consultations with professional bodies.

Eventually, it is intended NVQs will provide a ladder embracing all levels of vocational qualifications, but in terms of the existing framework it is likely the qualifications at Levels III and IV will meet the entrance requirements of institutions of higher education. With graded NVQs the Council is gradually putting in place the means of access and progression to the higher professional awards.

COURSES AND INSTITUTIONS ATTENDED BY STUDENTS ON BASIS OF VOCATIONAL QUALIFICATIONS

The proportion of students entering higher education on the basis of existing vocational qualifications (mainly ONC/D, HNC/D, BTEC, SCOTVEC) has risen steadily during the eighties, particularly in polytechnics and other public-sector institutions where it has increased from 8.8% of intake in 1981/2 to 13.2% in 1985/86. Growth in universities from a low base has been somewhat slower from 2.8% in 1981/82 to 3.5% in 1985/86.

These overall figures mask considerable differences between subject areas. In 1985/86, in polytechnics and other public-sector colleges, 32% of those on engineering and building courses, 13.9% of those on science courses, 9% of those on art and design courses and 6% of those on business and management courses entered on the basis of vocational qualifications. In the universities, the main areas entered were engineering and technology 10%, architecture and building 8% and business and administration 5%.

Vocational qualifications are most likely to be used as a basis for entry to higher education in those technologies where a degree is necessary to achieve full professional status. But units like communication studies have also been accepted for entry to degree courses, for example, English, which are not explicitly vocational.

Although the number of entrants to higher education in Britain with vocational qualifications has been rising it is still relatively low. Moor and Dean (1983) have obtained evidence that the demand for higher education among those with vocational qualifications is related to the importance which it is seen to have in career development. In occupations like engineering, where full professional status is restricted to graduates, demand was found to be strong, but among those in occupations where professional institute examinations were seen to be the means of advancement, interest in degrees was much lower.

PERFORMANCE IN HIGHER EDUCATION

Research has been commissioned by the NCVQ from us to determine the performance of students entering higher education on the basis of vocational qualifications, and some of the first results will be presented to the conference. But earlier studies have suggested that vocationally-qualified students can be very successful. Smithers and Dann (1974), for example, showed that the vocational entrant fared as well as most other students on degree courses in engineering at the University of Bradford.

This supported an earlier study by French (1967) which compared the degree results of 2,500 GCE and ONC students in six institutions. In all, 44% of ONC entrants compared with 39% of GCE entrants gained first or upper second class honours degrees. It is also interesting that more GCE entrants failed (7%) compared with ONC entrants (4%). The evidence (at least on the basis of these studies) suggests that, once accepted for a degree course, students with vocational qualifications can do at least as well as other entrants to higher education.

CONCLUSION

An important objective for National Vocational Qualifications is to provide a clear route of progression to higher levels of qualification including those based on degrees. Already some students do enter higher education on the basis of existing vocational qualifications and, with the advent of NVQs, especially where a degree is necessary to achieve full professional status, this is likely to increase considerably. Such a move would be welcomed by the Government and employers, and the institutions of higher education are actively considering admission requirements. The one-third fall in the age cohort in Britain creates a window for widening access. The available evidence suggests that students entering higher education on the basis of vocational qualifications can do very well.

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BIOGRAPHICAL NOTE

Professor Alan Smithers, B.Sc. (Lond.), M.Sc. (Brad.), M.Ed. (Manch.), Ph.D. (London and Bradf.), FRSHE, has held a chair in the Department of Education at the University of Manchester since 1977. He has published over one hundred papers in biology, psychology and education, and three books. The Education and Employment Programme which he directs is currently staffed by five full-time and three part-time researchers and has been funded from 19 different sources, including research foundations, government departments, commerce and industry, and other bodies.

COMPETENCY TESTS: THEIR ROLE IN SELECTION OF APPRENTICES AND TRAINEE TECHNICAL OFFICERS IN AUSTRALIA.

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Tests as a part of Selection Procedures.

The Educational Testing Centre (ETC) at the University of New South Wales (UNSW) in Sydney has been developing multiple choice tests for screening applicants for Apprenticeships for eight years. Over the last two years this has been extended to Trainee Technical Officers.

One of the main reasons for our initial involvement was the need for screening large numbers of applicants for relatively few positions. In 1980/81, with new Equal Employment Opportunity (EEO) legislation, this particularly affected state government bodies in New South Wales (NSW). Several of these had candidatures of 7000 -8000 with only 80 to 120 apprenticeships available. Screening by an objective measure such as a multiple choice test battery was seen as necessary to assess the competency of applicants to cope with trades courses at TAFE, and also to meet the accountability demands of EEO.

In 1981 existing selection tests were mostly very old (some were pre World War II) and over used, so that candidates were likely to have encountered some of them a number of times. Mechanical Reasoning and Ravens PM38, still widely in use, fall into both these categories. Further, most test batteries had a definite bias ***in favour*** of school leavers who were male and likely to have taken technical subjects at school and ***against*** females and those people from non English speaking backgrounds (NESB).

There was a need for locally developed tests that assessed basic skills required in TAFE trades courses *and* that reflected the skills and experiences applicants were likely to have been exposed to in their general education - not necessarily just schooling.

Employers were having problems with wastage of those people they put on, as well as a shortfall after the initial offers of positions. TAFE teachers were having problems with apprentices in their classes who needed remedial work or who dropped out of courses that proved to be beyond them. These problems are still with us, as a recent Seminar on Occupational Competency Tests, held at UNSW in May 1988, highlighted. There is a continuing need for interaction between secondary educators, TAFE educators and employers.

However, some large (and recently smaller) employers who have used the current ETC tests consider they have increased the likelihood of their apprentices being competent to pass TAFE courses as well as increasing the cost efficiency of their recruitment procedures and reducing the wastage from drop outs (Smith, 1988).

It is not unreasonable to consider the proposition that if funds from employers could be pooled then apprenticeship applicants could be screened by tests for entry to TAFE. This could also save multiple testing of many candidates who sit for several different employers' tests at present.

The Australian Scene.

Australia's young population of school leavers and those in their early twenties has changed over the last 20 years.

According to how the statistics are read, at present 15% of all Australians 15 years and over speak English as their second language (ESL) and in New South Wales 25% of all school children come from homes where a language other than English is spoken (NESB).

This means that the traditional pool from which apprentices (and those taking other TAFE courses) were drawn can no longer be assumed to come from an Anglo Australian background, and, in the case of apprentices, from families with a long history of a trade background. This traditional English speaking trades based source of apprentices has shrunk as a proportion of school leavers.

Consequently, employers face a shortage of the kind of apprenticeship applicant they know best, and TAFE teachers face classes of increasingly mixed skills and language backgrounds. Technical traineeships appear to have exacerbated this problem recently by increasing enrolments in the more advanced classes.

Secondary schooling also has had to change to meet the needs of more students staying on to Year 12, with wider and often less academic interests than the previous traditional student who was aiming for university or a college of advanced education.

In 1981 in New South Wales, the proportion of apprenticeship applicants (for State Government institutions) from Year 10 was 80 -85%: in 1988 it was closer to 50%, with 25% from Years 11 and 12, while the remaining 25% had already left school. This change in the age and educational levels of the pool from which apprentices are drawn has meant further difficulties for TAFE and employers, both in selection procedures and training.

Multiple choice tests that are being constantly evaluated and updated to meet these changes can help to tap this wider pool of resources and find out what applicants ***do*** know and what skills they ***do*** have. It can be argued that the older tests still in use tend to ***reduce*** the chances of finding the non traditional but competent applicants.

Such people, which include older people, females, and those from NESB and other disadvantaged backgrounds, have been named the "latent able" (Alcorn and Warrington, 1988). As their proportions grow we can not afford ***not*** to find, train and employ these latent abilities in our population.

Test Construction: Reducing Bias.

The double negative in the last sentence is a good example of English which disadvantages NESB candidates. That is, it is a source of unnecessary bias.

Other sources of language bias in test questions and instructions include:

- use of the passive voice.
- conditional clauses (such as the"if...then" variety)
- adverbs.
- many prepositions
- long sentences.

We have found that by reducing these kinds of language bias for NESB candidates we also have reduced the disadvantage based on socio-economic and/or rural backgrounds.

Most existing aptitude tests in common use have many sub tests, even those measuring numeric skills, which rely heavily on a candidate's skill in reading English. This also applies to the New South Wales Higher School Certificate (HSC) examination and the Australian Scholastic Aptitude Test (ASAT). The Proceedings of the Seminar on Occupational Competency Tests (Holdgate (ed), 1988) held in May this year, contain some interesting papers on the effects of language on test results. Contributions are from TAFE, secondary schools, employers, and Macarthur Institute of Higher Education which uses a special entry test as an alternative to the HSC for its local disadvantaged population (Alcorn & Warrington,1988).

English *is* the medium of communication in this country. When testing candidates for competency in a variety of skills, ETC's tests always include at least one sub test of English vocabulary and/or reading comprehension.

However, when testing mathematics, or Data Interpretation (in graphs, tables or charts) we remove or reduce the language component to a minimum (Diggs, 1988).

Details of the test construction methodology that we use are in the May Seminar Proceedings. Briefly, after the test questions are written they are reviewed and edited by a committee of four to seven people before and after pilot testing. After the pilot testing, the statistical data helps in the decision making as a useful tool for people with the experience to make informed judgements about the content and structure of tests and their items.

The people who work on this committee vary according to the content, purpose and level of the test, but always include those with a background in one or more of the following:

- test construction, theory and practice.
- specialist subject knowledge and teaching experience.
- teaching English as a second laguage and/or experience as an ESL Australian.
- experience in selection/recruitment procedures.

Pilot testing is carried out over a wide range of schools from Years 10 to 12, making sure that females and NESB people are usefully represented. We also include first year university students in the pilot tests designed for trainee technical officers.

From the statistical analysis we look for bias based on language background, gender and age. Word knowledge, for example, continues to increase with age, so that separate tests for different age groups often prove more useful than separate age norms for the same vocabulary test.

Differences in mathematics scores (not necessarily an indication of bias) between the sexes are decreasing or non existent at the school leaver level. Female candidates usually do as well as the males on the apprentice mathematics tests.

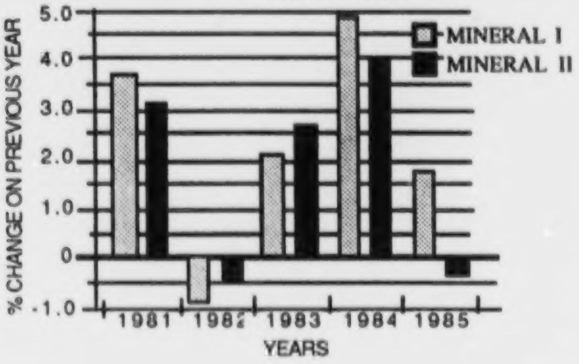
However, some older tests in traditional batteries we do consider biased against females. We do not construct or recommend tool recognition tests or Mechanical comprehension type tests for two main reasons. The 1976 version of the Kit of Factor Referenced Cognitive Tests (Ekstrom & French,1976) has removed the Mechanical Knowledge test on the grounds that it was found to be based on achieved skills. Girls in many Australian high schools still find it difficult to take Technical Drawing and other technical subjects, and therefore have often not had the relevant experience. For the same reasons we have moved away from our earlier Scientific Method tests as we found that girls and boys in high school were being taught science with differing content emphasis, particularly in single sex schools. Also, in New South Wales the secondary science syllabus to Year 10 allows for wide variation within schools for determining the details of content taught.

Instead we use a Data Interpretation test which is designed to be free of content taught in school. This test measures skills and processes used in extracting and manipulating data, which for technical courses is based on scientific and technological stimulus material taken from a wide range of resources, such as journals, newspaper articles etc. Students are not expected to have learned about the content of this material. They *are* expected to be able to use it.

Figure 1 gives an example of three data interpretation items based on graphical stimulus material.

FIGURE 1:

GRAPH: Change on Previous Year in Production of Two Minerals



1. In 1983/4, production of Mineral II increased by

   (A) 2.1 %　　(C) 2.7 %
   (B) 2.2 %　　(D) 3.7 %

2. The greatest % increase in production of Mineral I and Mineral II was in

   (A) 1982/3　　(C) 1984/5
   (B) 1983/4　　(D) 1985/6

3. The least % change in production of Mineral I was in

   (A) 1982/3　　(C) 1984/5
   (B) 1983/4　　(D) 1985/6

These kinds of items are commonly found in science and maths tests but combined in a single sub test the statistics show they are measuring a separate area of skills and the reliability indices (KR20) are much higher than with traditional science tests. This example also shows how the language used is reduced to minimize bias caused by language background (NESB or socio economic).

Figure 2 shows two examples of mathematics items with the English reduced to a minimum in the 'B' versions.

FIGURE 2.

1A. If a vehicle is travelling at x kilometres per hour, then its speed s in metres per second is given by the formula

$$s = \frac{5x}{18}$$

If a car is travelling at 25 metres per second, what speed in kilometres per hour is it travelling at?

(A) 3.6 km/h
(B) 6.9 km/h
(C) 90 km/h
(D) 2250 km/h

1B.

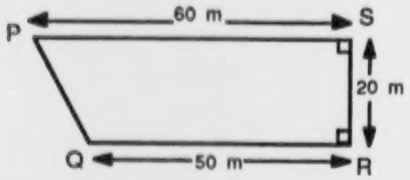
$$s = \frac{5x}{18}$$

$$s = 25$$

$x =$
(A) 3.6
(B) 6.9
(C) 90
(D) 2250

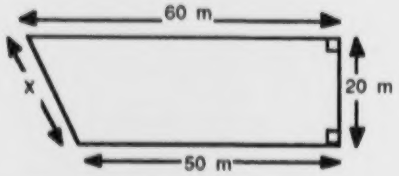
2A. An irregular shaped building block has the shape and dimensions shown.

What is the approximate length of the street fence PQ?



(A) 17 m
(B) 22 m
(C) 30 m
(D) 100 m

2B.



x is closest to
(A) 17 m
(B) 22 m
(C) 30 m
(D) 100 m

(from Diggs, 1988)

NESB candidates do as well or better than native English speakers in Mathematics and Data Interpretation tests containing these kinds of items, particularly in the upper half of total test scores.

More specific detail on methodology, sampling and findings is available in various papers listed in the References.

Validation of Tests: New Developments and the Significance of How Test Results are Used.

This a vital and large issue. A paper by Joan Curphey in the Seminar Proceedings (Curphey 1988) gives details of a large scale validation of a Clerks test based on new uses of criteria.

Briefly, traditional validation methods, based on criterion related or concurrent variables producing regression lines for making predictions, are expensive, long term and often inconclusive. They are also very difficult to explain to test users and the public. In the United States a number of court cases concerning test validity have led to a simpler approach which uses elements of both content and construct validity. We have adapted this approach for local use.

Two criteria must be met:

- does the content of the test measure important skills and processes involved in TAFE courses or on the job?
- can the skills and processes being tested reasonably be expected to have been part of candidates' previous experience?

In the Clerks test validity study described by Curphey, the basis for assessing these criteria was to ask the job incumbents and their immediate supervisors what were the important skills they used on the job. They were asked to fill in a questionnaire which listed tasks in verbal, numeric and other areas. These tasks could be linked back to skills, at various levels and psychological constructs via the Australian (ASCO, working draft 1983), Canadian (CCDO,1971) and American (DOT, 1965) dictionaries of job skills. The data produced was easy to interpret and explain, and the approach was free of any suggestion of job appraisal.

At this stage no such study has been undertaken with ETC's Apprentice or Trainee Technical Officers tests. An appropriate questionnaire is planned for 1989, with assistance from TAFE staff. At present the validity of these tests rests on the initial inputs of local apprentice trainers, the literature, two visits to the U.S.A. and one to the U.K. Most important has been the response of the test users, who originally used the tests for EEO accountability purposes, and now express their satisfaction with the cost benefits, an increase in retention rates, and success in TAFE courses by their apprentices who were initially screened by the tests.

It should be emphasised that ***use*** of tests and their results is also a vital aspect of test validity (APA, Standards for Educational and Psychological Tests, 1985). Tests must be designed to specifications that apply to the population and purpose for which they are written if they are to be considered valid. This means that an important aspect of test validity lies with the user of a test and its results, as well as with the test developer.

This takes me back to an earlier point: the need for interaction between TAFE, secondary education and employers.

Finally, at the 24th International Congress of Psychology, held in Sydney last September, several speakers made the point that any objective test increased the predictability of success in recruitment for courses or jobs. The next most useful predictor was biographical data! The lowest predictability came from selection procedures that relied only on subjective judgement and "gut feel". Dr. John Toplis, from the British Post Office, also warned that there were many glossy but unsubstantiated tests on the market, and that the most useful and valid were those designed locally, to proper test specifications and rigorous rules of test construction.

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Biographical Data

Qualifications:	B.Sc (NZ) 1957, Dip Ed. (UNE) 1974, M.Ed. (hons), (UNE) 1977.
Experience:	The author taught secondary school science for 16 years, completing a thesis in psychometrics as part of the M.Ed. during that time. Since 1981 she has worked at the Educational Testing Centre of the University of New South Wales, Sydney, Australia, evaluating and constructing vocational selection and alternative tertiary entry tests, with particular emphasis on the causes of bias against disadvantaged sections of the Australian community. Two Seminars, in 1984 and 1988, were organized for employers and educators. In 1985, the author visited the United States and Britain to discuss selection testing and its implications (particularly accountability) with test developers, academics and large government institutions. Since 1982, seven Occasional Papers dealing with these issues have been written and are available from the Educational Testing Centre. Consultation with the Assessment Research and Development Unit (ARDU), TAFE, Sydney has been ongoing, including being part of an interview selection panel.
Memberships:	Member of the Australian Association for Research in Education Inc. (AARE), Australian Science Teachers' Association, New South Wales Science Teachers' Association. Committees include the Public Service Board of NSW Steering Committee for the Clerks Entrance Examination Validation Study, ETC Examination Working Committee (Coordinator).

DEVELOPMENT AND ANALYSIS OF A CRITERION-REFERENCED TEST ITEM BANK

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The state of Arkansas has approximately 12,000 tractor-trailer truck drivers. To meet the needs of the truck driving industries, 11 of the state's 24 postsecondary vocational technical schools provide training in tractor-trailer/truck driving. Training consists of a minimum of 270 student contact hours. United States Department of Transportation mandated testing for tractor-trailer/truck driver licensing will be effective in Arkansas in January 1990. To address the need for preparing competent drivers, the Division of Vocational Technical Education, Arkansas Department of Education determined to develop a standardized competency-based curricula for truck driving. Inherent in competency-based education is the need for criterion-referenced testing. Therefore, the state commissioned the construction of a test item bank from which each truck driving instructor in the state could draw test items. To produce a high quality test item bank keyed to specific tasks essential to job success, the Vocational-Technical Education Consortium of States (V-TECS) process was used. V-TECS is a cooperative research and developmental effort among 27 states with associate membership being held by the armed forces, Department of Labor and Bureau of Prisons. Each member provides products and services for mutual benefit to eliminate duplication of efforts in the development of competency-based curricula. Standard procedures are used to insure uniformity in the products and to promote transportability of the products among states. The use of incumbent workers as experts to validate the product is an essential component of the V-TECS process. The following is an outline of the procedures used in Arkansas, a V-TECS member state, in producing test items for a criterion-referenced test item bank:

Procedures for Test Item Writing

The Tractor-Trailer/Truck Driving V-TECS Catalog was revised in 1986-87 by Arkansas. The catalog consisted of duties (a cluster of related tasks performed by incumbent workers in an occupational domain) and tasks (a measureable unit of work with a definite beginning and ending, consisting of two or more steps). These duties and tasks were used as a basis for test item development; items were keyed to the duty/task codes. Also included in the catalog were tools, equipment, and work aids essential to the occupation; standards, conditions of performance, and performance guides were also listed. Information from the catalog was a resource for item development. A writing team consisting of five instructors was identified. The writing team was trained in V-TECS procedures to insure consistency in both format and content.

Task Analysis

An in-depth task analysis was accomplished through a process by which a research associate rode with truck driving instructors and students as they performed the various duties and tasks identified in the catalog as being essential to truck driving. A tape recorder was used to record comments and answers to the researcher's questions during the course of a drive. The researcher often verbalized events taking place and asked key questions to determine the exact steps necessary to accomplish a particular task. These informal comments were later transcribed. Notes from these transcriptions were reviewed with instructors and incumbent workers to determine their accuracy.

Item Writing

After task analysis, the researcher worked with the writing team to develop items, making suggestions based upon information gathered during task analysis for construction of the items. The writing team provided the content information and plausible distractors for the multiple choice and matching items (cognitive domain). Performance checklists (psychomotor domain) were constructed from steps outlined by the writing team and notes from the task analysis. After the test items were completed, they were reviewed by incumbent workers to confirm the accuracy of item content. A total of 164 multiple choice items, 12 matching items, and 37 performance checklists were written.

Field Testing Items

Field-testing sites were established in the 11 postsecondary vocational technical schools offering truck driving programs. The 164 multiple choice and 12 matching test items were divided in three subsets, with each subset being tested separately. The performance checklists were given to the instructors; however, the instructors were not required to test every student with every checklist. (Results from the checklists were not considered in analyzing the field tested items.)

Uninstructed/Instructed Samples

Samples from two populations were tested: uninstructed and instructed groups. The uninstructed subset sample sizes ranged from 29 to 30; the instructed subset sample sizes ranged from 30 to 53.

Statistical Treatment

Two statistical treatments for item analysis of criterion-referenced test items were used on each of the multiple choice test items. The easiness index is defined and computed the same way for criterion- and norm-referenced test items. In criterion-referenced measure, one would expect that the uninstructed group would score low on an item and that the instructed group would achieve a high score on the same item. On items which did not reflect different results for the two unrelated groups, the tasks to which the items were keyed or the specifications for constructing the item were reviewed.

The second statistical treatment used was the Brennan Index. The Brennan Index *(Brennan 1971)* is an index of how well an item discriminates between two unrelated groups.

$$B = (N\ right\ instructed / N\ instructed) - (N\ right\ uninstructed / N\ uninstructed)$$

The Brennan Index was used because the samples in this study were taken from two unrelated populations. For this study, a Brennan Index of +.40 was used to divide the items between high and low discrimination.

(This treatment of individual items does not assume that an instrument generated from the item bank is an adequate total instrument. Further data will be collected upon administration of tests generated from the item bank to assess reliability and validity of the instruments. Multiple items keyed to the same task will also be analyzed further.)

Final Reviews

The statistical treatments aided in identifying multiple choice items which did not actually measure the intended learning (tasks). Items whose easiness index did not increase in magnitude from uninstructed to instructed groups were suspect (*Popham, 1971*). Items whose discrimination index did not exceed +.40 were examined. Fourteen items had a Brennan Index of +.40 or higher. One hundred twelve items had a Brennan Index of less than +.40. Items whose discrimination index indicated a decrease in the percentage of students who answered correctly from uninstructed to instructed groups were suspect as being faulty in construction. Thirty eight items in the bank had a negative Brennan Index. In some cases, instruction could have been confusing. Three items were keyed to tasks not included in the course content of the instructed groups. These statistical treatments were helpful in identifying items which needed to be further revised or discarded. As a result of this analysis, four items were discarded; 66 items were revised.

The following are three examples of analysis results:

Item #103

The fifth wheel connects to the:

- *a. axle saddle.*
- *b. glad hands.*
- *c. king pin.*
- *d. landing gear.*

Uninstructed Easiness Index	.03
Instructed Easiness Index	.96
Brennan Discrimination Index	.93

Interpretation: Item has low Uninstructed Easiness Index and high Instructed Easiness Index with a high Brennan Index. The item discriminates well between instructed/uninstructed groups.

Recommendation: Keep item as is.

Item #122

While in route, your refrigeration unit's safety switch shut off. You should first check:

- *a. freon level, engine temperature, oil level, and battery.*
- *b. engine temperaure, belts, fuel level, and oil level.*
- *c. engine temperature, trailer temperature, fuel level and coolant level.*
- *d. fuel level, oil level, coolant level, and battery.*

Uninstructed Easiness Index.	.11
Instructed Easiness Index	.21
Brennan Discrimination Index	.10

Interpretation: This item is difficult for both instructed and uninstructed groups. The Brennan Index of .10 indicates little discrimination between the two groups. Examination of the options reveals that the options may be confusing.

Recommendation: Rewrite the item with simplified options.

Item #151

A radiator cap should NOT be removed while the engine is:

- *a. cold.*
- *b. hot.*
- *c. idling.*
- *d. running.*

Uninstructed Easiness Index	.93
Instructed Easiness Index	.92
Brennan Discrimination Index	-.01

Intrepretation: The Easiness Indices for both instructed and uninstructed groups indicate the item is very easy. The Brennan Index indicates that the item discriminates very poorly between the two groups. This item probably tests information that is general knowledge and not specific to the truck driving curricula.

Recommendation: Delete the item.

Uses of Test Item Bank

The test item bank is available to instructors in the state's postsecondary schools. Tests generated from the bank can be obtained by the instructors upon request. Specific task areas can be identified and custom tests can be generated through a computer-based management system. Suggested uses include pretesting for instructional placement, posttesting for task verification, and program improvement. Competency profiles based upon test results can be issued to exiting students.

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FOLLOW-UP STUDIES OF VOCATIONAL AND TECHNICAL EDUCATION GRADUATES USING STATE DATA BASES

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Evaluation of social programs continues to be a major challenge the world over. Taxpayers question the worth of such programs. Policymakers, charged with setting priorities and making tough program choices, attempt to determine their value relative to other programs. Advocates and users of such programs demand to know their quality. Within these frameworks, evaluation occurs.

This paper proceeds on the assumption that the more specific the social program, the more stringent are the demands for evaluation. From this perspective, employment and training programs in general, and vocational education programs in particular, are examined with an eye towards utilizing new technologies to aid in their evaluation.

Vocational education has been evaluated through the years in terms of its specific purpose–that is, preparing people for meaningful employment. While some argue that vocational education's mission has gradually broadened during the last 25 years since the term "education" implies more than "training," few disagree with its primary emphasis on students securing jobs. Its specificity in mission, individuals served, and curriculum emphasis call for close scrutiny by decision makers on all levels. The fact that for the past 15 years the U.S. Congress has demanded repeated evaluations of vocational education and required both states and local education agencies to improve evaluation efforts only demonstrates the high priority that vocational educational evaluation has in the nation.

Evaluation of vocational education, as in other social programs, can assimilate many characteristics. But in the final analysis, most agree that "the student on the job" is the standard of excellence. State directors of vocational education in 1981 rated employer feedback and placement level as the primary indicators of program quality (Wentling and Barnard, 1982). How such indicators of program quality are generated is the primary focus of this paper and is referred to as follow-up research.

Smith, (1974) suggested the following conception of follow-up research:

> ...follow-up as an organic component of the total vocational education operation, is a serviceable, two-edged instrument contrived by vocational education professionals to both require program quality and to determine objectively unmet training needs (p. 213).

Follow-up studies have been used over the years to gather pertinent information relative to employer satisfaction and student placement. Employer satisfaction and/or opinion generally focuses on one of three areas:

Employer Follow-up Studies - Studies that ask a specific employer/supervisor questions about particular employees who are former vocational education students.

Specific Employer Surveys - Studies that ask employers who are known to have hired former vocational students questions about vocational education or vocational graduates as a group.

General Employer Surveys - Studies that ask employers who may or may not have hired former vocational education students questions about vocational education or its products. (Asche & Vogler, 1980, p. 55).

While employer surveys provide pertinent information on current and future employer needs, student placement rates reveal the past success of particular vocational education programs. However, as Hartz et al. (1978) suggested, specific skill training may not be the only factor that affects job placement. Other employability skills such as social and communication skills may also play a prominant role in a student's education and eventual employment. Datta (1980) argued that the following factors, external to the education process, might be determinants of a high placement level:

A one-time expansion of the job market.
An assertive placement system.
Low competition.
No preferred alternatives to employment.
Selecting applicants.
Good working conditions.

Notwithstanding these considerations, or limitations as some might suggest, led to development of an alternative process for collecting student follow-up information that will be described in the remainder of this paper.

Student placement rates or levels have traditionally been generated through personal surveys with former students, either in-person or through some medium such as the mail or telephone. This particular process, as in any research process, presents some fairly significant constraints. One immediate problem is the response rate. This is especially true in longitudinal studies spanning more than a year since vocational training was provided. Costs associated with tracking down former students can be significant. Another problem exists with follow-up studies based on a less than satisfactory response rate and the resultant possible bias. If such a study has only a 50 percent response rate this may not be a representative sample of which to base conclusions. Lastly, such self-reporting may contain inaccuracies based upon ego inflation or on the possibility that requested financial information might not be readily available to the respondent or that the respondent may not wish to produce the requested materials.

In an attempt to eliminate these constraints from securing follow-up data from graduates, the Vocational Studies Center at the University of Wisconsin-Madison is conducting research to generate this relevant information from other sources. Over the years, computerized data bases have grown to a tremendous degree. Albeit the concerns of George Orwell and 1984, information on individuals stored by various units of government and the private sector continue to enlarge. If and when these data bases can be compared and analyzed, relevant student follow-up information can be identified in a more efficient manner.

Precedence for such a methodology was developed by Ghazala (1981, 1987) who, in two instances, examined Ohio vocational education graduates by use of their Social Security numbers against federal tax records. Rather than attempting to replicate such an endeavor with the federal bureaucracy, the Center sought to expand such an examination within the State of Wisconsin and its own data bases.

Center personnel investigated the employment status and earnings profile of graduates of the Wisconsin Vocational, Technical and Adult Education System (VTAE) for a given year. Programs within the VTAE system are postsecondary and mostly of a vocational nature and can span the instructional time of six weeks up through two-year associate degree programs. Graduates' income, wages, and public assistance levels were than matched and compared to data bases of three state agencies. In addition, a control or comparable group was established so that comparisons between graduate and "non-graduate" groups with similar individuals could be made. The process consisted of the following steps..

Step One. VTAE graduates for the program year 1982-83 were identified. A total of 15,959 graduates met the study's definition of vocational education graduates. Social Security numbers were obtained for these students. From the VTAE data base, six other items of information on each student was also secured. These were as follows:

Gender
Age
Program Area
Geographical Region
Length of Instruction
Possession of Economic Disadvantagement

Step Two. The data base was then analyzed against the data base of the Wisconsin Department of Revenue for possible matches with all persons filing 1985 Wisconsin state income tax returns. A total of 12,982 matches, or 81.3 percent were found. The following information on these matches were then generated by the Department of Revenue.

1985 Mean Income
1985 Unemployment Compensation Received
1985 Residence
1985 Marital Status
1985 Number of Dependents
1985 Wisconsin Income Taxes Paid

Step Three. Based upon this information, numerous permutations and combinations were performed so that a profile could be produced on the 1982-83 VTAE graduates as they performed in calendar year 1985. For example, mean incomes were broken down by program areas and compared. The same was done for geographical regions within the state, and so forth. The amounts of unemployment compensation received by 1982-83 graduates were compared with the amounts received in 1985 by the general population in Wisconsin (Source: Wisconsin Department of Industry, Labor and Human Relations). A retention index was produced, comparing the geographical region of instruction and analyzing it against the region in which the graduate resided when he/she filed the tax form in 1985.

In order to establish a comparison group, the researchers relied on the following statistical technique. Per capita income for the five geographical regions in 1985 was derived by computing a weighted average of county per capita income using U.S. Bureau of the Census data. The mean income figures on graduates was deflated by .03 to derive mean earnings. This figure was based on the national ratio of total income to earnings and was also borne out by the information supplied by the Wisconsin Department of Revenue. Mean earnings for the VTAE graduates in Wisconsin were then compared with adjusted national mean earnings of persons who completed four years of high school. These comparisons took appropriate account of the age and/or gender of the groups being compared. National mean earnings were also adjusted in order to take into account regional income differences. Again, appropriate tables and graphs were prepared.

A third data base that was examined in the course of the current research was that of the Wage Reporting System of the Wisconsin Department of Industry, Labor and Human Relations (DILHR). Initially constructed during 1987, this system, with data available for the first quarter of 1988, acquires wage records from all Wisconsin employers, except the federal government, on a quarterly basis. Wisconsin employers identify by Social Security number each employee together with that employee's earnings for that quarter. The data file of 15,959 1982-83 VTAE graduates was run against the initial filing for the first quarter of 1988 of the Wage Reporting System with the following results. Matches were made of employees on the average of five and one half years after completion of programs, on 11,220 employees or 70.3%. Upon further examination, 1,903 of these 1982-83 graduates and 1988 employees showed no income reported for 1988. The majority of these non-reports were attributed to the newness of the system, in that although their Social Security numbers had been entered, somehow earnings for 1988 were omitted. In all, 9,317 or 58.4 percent of the 1982-83 VTAE graduates were found as receiving 1988 earnings in the Wage Reporting System. A factor of four was then applied to the mean earnings to estimate a projectd annual 1988 mean earnings for graduates. Tabulations and cross-comparisons were then done similar to the analysis performed with 1985 income tax data.

In order to develop a comparable group to compare to these data, the 1985 control group was adjusted to account for inflation and cost of living increases, and was included in the study. In addition, through statistical manipulation, a mortality and out-state migration ratio was developed to attempt to account for those graduates not found in the Wage Reporting System in 1988.

Lastly, the file of 1982-83 VTAE graduates was compared to the data base at the Wisconsin Department of Health and Social Services (DHSS) which contains the Social Security numbers of all Wisconsin residents currently on some kind of state-financed or state-audited public assistance. These results were then compared to the general population's incidence in these programs and reported.

The reserach reported on herein is an initial attempt to combine the advantages and efficiencies brought about by new technologies, most notably data storage, retrieval, and analysis with the expectations of accountability and evaluation. While not a panacea, the techniques utilized in this research study overcome a number of constraints currently implicit in traditional follow-up research and addressed earlier in the paper. There is also every reason to believe that cost efficiences, both in dollars and in human resource hours, can be attained.

It is appropirate to relate to the question of confidentiality. The study has been done without compromising confidentiality even though data was collected by Social Security numbers since agencies furnished data only in pre-designed tables with no cell smaller than 10. Coding systems are in place, however, in the agency so that these same individuals can be followed up in future years.

Going beyond this study, one can envision more delimited applications to specific programs, individual institutions, and pre-planned comparison groups such as graduates compared to early leavers. Other employment and training programs as well as other forms of education might consider its application for determining, if nothing else, current or future disposition of their clients.

Lastly, states and even countries around the world, with perhaps a less sophisticated data storage and retrieval system, might wish to ponder pertinent applications for themselves while they still designing and/or implementing such systems.

Our preliminary data on former students shows very positive results relative to retention in the labor market area in which training was provided, in employment, wages, and lack of dependence on social services. We believe it is the success of the thousands of students who have benefited from vocational education that reflects on the quality of programs and we are excited about the possibilities of measuring this success through data bases that have only recently been used for this purpose.

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WORKSHOP C

Theme: Curricula in Vocational Education.

Monday March 13. 11.30 am; Friday March 17. 3.30 pm.

Adelaide Room 3

Professor Richard Gagnon. Faculty of Science of Education, Laval University, Quebec, Canada. *Teaching of Scientific Concepts in Vocational Education.*

Mr. Brian Thomas. Senior Head Teacher, Electrical Trades, Petersham College of TAFE. *Fast Track Apprentices and Multi-skilling: Can we have the best of both worlds? An argument from curricular relevance and coherence.*

Ms. Clare McBeath. Curtin University of Technology. *Collecting Case Studies in TAFE Curriculum: Some problems.*

Mr. A.J. Stewart and Mr. J. Onions. West Oxfordshire Technical College, United Kingdom. *Distance Learning Material to be used by Trainees in the Thoroughbred Horse Industry.*

ANALYSIS OF A PROGRAMME OF ELECTROMECHANICS OF AUTOMATED SYSTEMS IN TERMS OF UNDERLYING PHYSICAL CONCEPTS AND PRINCIPLES

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Interest is growing in many occidental countries in scientific and mathematical knowledge as a necessity for efficient technical and vocational studies. Students however have great difficulties dealing with such content as they do not master it sufficiently nor particularly like it. Thus, it is of utmost importance to rely only on what is absolutely necessary at the most basic level compatible with the formation objectives. In addition, to make learning significant and appropriate, a close integration of science and technical content is to be seeked.

METHOD OF ANALYSIS

To identify the relevant mathematical and scientific material, programmes should be analysed as they contain in principle all the elements required to reach the formation goals. Most often than not, at least in North America, they are devised using hierarchically organized performance objectives. Three levels are mostly used: terminal (stating the main objective of the module or course), intermediary (a step by step way to achieve the terminal objective) and specific (the actual content to be learned). In this kind of analysis, the content itself must be looked at, as interpreted from the higher level objectives perspective. Three points of view must be taken into account simultaneously: scientific, technical and pedagogical. Therefore, for precise results, a multidisciplinary team is almost mandatory. Proceeding from the exploration of the scientific conceptual family of the object study to the determination of the exact concepts and/or principles essential to the achievement of the objective and of the necessary skill levels required using a specificity criterion (such that the number of prerequisites is minimal), a method was developed and applied to a programme of electromechanics of automated systems at the secondary school level.

The method itself, based on the formulation by objectives of the programme and on the existence of a skill level taxonomy, is in four steps and applicable one objective (in our case intermediary) at a time. Firstly it ensures that the objective under study is well understood by the analysts making use of Bloom's taxonomy; secondly that the content to be learned is suitable to the objective (in case that it is not, the content is to be adjusted); thirdly that the selected concepts and principles are those that minimize the prerequisites to their knowledge at the skill level required to achieve the objective;

fourthly that the vocabulary utilized be the one of the scientific discipline looked for (physics, chemistry, biology, etc.). It thus allows for the determination of the exact concepts and principles at the right intellectual skill level really necessary to the achievement of every single objective. For more details, see Besançon et al. (1988).

APPLICATION AND RESULTS

As an example, we present results of concepts and principles in physical sciences (CPPS) relevant to two large blocks of the above mentionned programme: Industrial Mechanics, 625 hours and Fluid Energy, 300 hours. Altogether, 109 intermediary objectives detailing 18 terminal objectives were analysed as well as two more terminal objectives directly expressed into learning content. Table I lists the CPPS's that were identified. 41 concepts were found in the Industrial Mechanics block of which 23 fall in the Mechanics subcategory of physics, as could be expected.

Table I. Concepts and principles of Physical Sciences extracted from Industrial Mechanics (I.M.) and Fluid Energy (F.E.)

Family	Concept/principle	No	I.M.	F.E.
Mechanics				
Kinematics	Position	1	X	X
	Distance	2	X	X
	Motion	3	X	X
	Speed	4	X	X
	Acceleration	5	X	X
Translation dynamics	Inertia	6	X	
	Force	7	X	X
	Tension	8	X	
	Elasticity	9	X	X
	Gravity	10	X	
	Weight	11	X	X
	Friction	12	X	X
	Power	13	X	X
	Efficiency	14	X	
	Angular position	15		X
Rotational dynamics	Rotation	16	X	
	Rotation axis	17	X	
	Torque	18	X	X
	Principal axis	19	X	
Vibrations and waves	Vibration	20	X	
	Frequency	21	X	
	Amplitude	22	X	
	Intensity	23	X	
	Resonance	24	X	

(cont'd)

Electricity	Potential difference	25	X	X
	Direct current	26	X	X
	Alternating current	27	X	X
	Electric circuit	28	X	X
	Electric arc	29	X	
Fluid mechanics	Flow	30	X	X
	Continuity	31		X
	Pressure	32	X	X
	Gas compressibility	33		X
	Liquid incompressibility	34		X
	Pascal law	35		X
	Bernouilli's theorem	36		X
	Torricelli's law	37		X
	Viscosity	38	X	X
	Laminar flow	39		X
	Turbulent flow	40		X
	Capillarity	41	X	
	Fluid-tightness	42	X	X
Thermo-dynamics	Heat	43	X	X
	Temperature	44	X	X
	Ideal gas law	45		X
	Relative humidity	46		X
	Heat flow	47	X	
	Linear expansion	48	X	
Matter	Ray	49	X	
	Phase	50	X	X
	Adhesion	51	X	
	Homogeneity	52		X
	Permeability	53		X
	Porosity	54		X
	Crystal lattice	55	X	

In the Fluid Energy block, 32 concepts and four principles were extracted, with 12 concepts each in Mechanics and in Fluid Mechanics, the latter being presumably the natural basis of Fluid Energy. Moreover, 22 concepts are common to both blocks.

A more quantitative comparison is needed though. In order to do so, we assume as it seems reasonable that any given CPPS will be needed during the total duration of the objective requiring it. Obviously the shorter the objective the truest that is. Its total importance, noted I_{cp}, can then be obtained by summing over all durations of its occurrences.

The results are presented in Figure 1. Clearly CPPS's are of varied importance, a small number of them dominating the distribution. One can easily show that the actual number of CPPS's decreases almost exponentially with importance. In other words, few of them are needed for a large fraction of the total time. In Industrial Mechanics, speed, friction, elasticity, heat and heat flow are

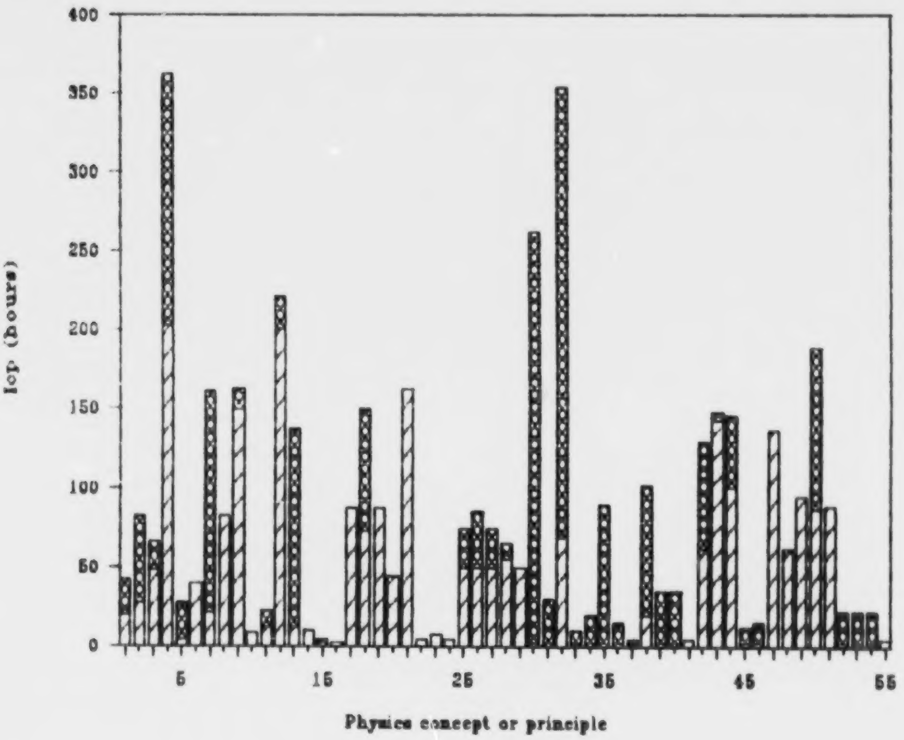

Figure 1: Cumulated importance I_{cp} of concepts and principles of physical sciences extracted from Industrial Mechanics (slashed part) and Fluid Energy (crossed part)

the most important while in Fluid Energy, pressure and flow are overwhelming.

It is also revealing to calculate the total importance of all CPPS's by physics family as shown in Table II. Again it is obvious that Mechanics is the basis of Industrial Mechanics but also that Fluid Mechanics is the one of Fluid Energy even though less strongly. The last two columns of the table refer to the CPPS's that are namely explicit in the programme. It is disturbing that these numbers are so low as the CPPS's are deemed necessary to the achievement of the programme's goals.

CONCLUSION

Let us briefly summarize what can be learned from that kind of analysis. Clearly the results correspond to the scientific knowledge that the student must have to go through his/her curriculum. Moreover, if the tendancy shown in our data persists in other programmes and for other sciences, i.e. most CPPS's among the dominant ones

Table II. Importance by physical families I_F of concepts and principles of physical sciences. The second and third rows refer to the contributions of Industrial Mechanics and Fluid Energy respectively.

Physical family	I_F (hours)	I_F/I (%)	I_{Fexp} (hours)	I_{Fexp}/I_F (%)
Mechanics	1 985,00	45,1	638,75	32,2
	1 317,50	53,8	308,75	23,4
	667,50	34,3	330,00	49,4
Electricity	350,00	8,0	0,00	0,0
	255,00	10,4	0,00	0,0
	95,00	4,9	0,00	0,0
Fluid mechanics	1 093,75	24,9	338,75	31,0
	158,75	6,5	51,25	32,3
	935,00	48,1	287,50	30,7
Thermodynamics	522,50	11,9	23,75	4,6
	445,00	18,2	18,75	4,2
	77,50	4,0	5,00	6,5
Matter	446,25	10,2	12,50	2,8
	276,25	11,3	12,50	4,5
	170,00	8,7	0,00	0,0
TOTAL (I)	4 397,50	100,0	1 013,75	23,1
	2 452,50	100,0	391,25	16,0
	1 945,00	100,0	622,50	32,0

are daily concepts, a common science course could be developed and taught separately or required for admission. The method can also serve as a sort of consistency check for that aspect of a vocational programme dealing with mathematical and scientific requirements. Finally the results can be transformed into didactic material for teachers and students as they provide together with the technical content all that is necessary to construct an integrated techno-scientific structure of each objective, course and in the end, of the formation discipline.

Acknowledgments

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FAST TRACK APPRENTICESHIPS AND MULTI-SKILLING: CAN WE HAVE THE BEST OF BOTH WORLDS? AN ARGUMENT FROM CURRICULAR RELEVANCE AND COHERENCE

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Any effective vocational education or training program must be externally relevant and internally coherent. External relevance lies in the program's capacity to develop knowledge and skills necessary for anticipated vocational tasks, as measured in the degree of work-place preparedness possessed by graduates. The correlation between industrially necessary skills and skills evident in successful completion of the program's assessment schedule is the overt sign of the program's external relevance.

The program's coherence may be measured by the mutual consistency and integration of the topics treated. Implicit in any estimate of coherence is some degree of both logical and psychological connectedness. Logical connectedness is evident in various ways, for instance where one theory or concept is logically required in the definition of another. One would not normally attempt to cover "power" without first covering "force", since power is defined in terms of force. Psychological relevance is similar, but less formal; for example treating the behaviour of permanent magnets before considering electro-magnetic relationships and behaviours. There needs to be a clear structure within the program reflecting the conditions for understanding and mastering its content.

In this paper we consider fast track apprenticeships and multi-skilling in terms of curricular relevance and coherence.

Fast Track Apprenticeships

There is a range of on-entry abilities and experiences in the student body of any given TAFE course. There are also varying educational potentials among students. Moreover, some students might already have abilities and experiences included in the aims of the course's skills development profile; others who lack such skills might acquire them more quickly than their peers. To maximise individual equity and avoid waste and duplication, curricula should be developed which can flexibly and practicably accommodate the majority of such individual differences.

Provision might be made for immediate advancement of some students. A student enrolling in the first year of an Electrical Trades course might have a good HSC result in Physics, along with other experiences considered equal to a first semester theory subject. Granted, in considering both what to count as an on-entry qualification or skill permitting immediate advancement, and what form that advancement should take, we should be very cautious about drawing up lists of standard exemptions; but there is a case for allowing such a student to sit the subject's assessment procedures and if successful to be exempted from attendance and move into the next phase of the program.

There is further room for caution here, however. Claims of good cause to be advanced in theory based subjects are more likely to be resolved by this procedure than claims for practical subjects. But most subjects not employing a formal weekly assessment could probably be managed like this, including practical subjects where the practical component of the overall mark is determined by class tests rather than an assessment of each week's work. In these cases if a student makes claims for an exemption from attendance, supported by his or her employer or other outside agent, refusal needs justification.

Class size is a relevant consideration. Perhaps where employers take on as first year apprentices a group of students constituting an acceptable class size, a shortened attendance requirement could be arranged so that the students covered all work not yet experienced or mastered. All the standard assessment procedures would be administered. To be effective, this would require industry to organise so as: (i) to ensure that any class load of such students, with a common background, attend a particular college, and (ii) to put a case for the attendance exemption on the basis of the special selection procedures by which they have been chosen for employment. Given these conditions, and one further proviso, that there is no further reduction in overall paid release for formal training, there should be no barrier to this form of "fast track apprenticeship".

For an exemption to be granted, industry would need to make or support the claim of a particular apprentice to exemption. Independent substantiation of the relevant experience is necessary. Moreover, since TAFE exists largely to serve the needs of industry, industry should be obliged to identify its needs, including those relating to experience relevant to exemption from attendance. It should be able to indicate which skills might already be possessed in virtue of school experience, and which are acquired through everyday work experience, in that they are inherent in the successful performance of required tasks. By "industry", here, we mean industrial unions as well as employers. It can be argued that unions have a responsibility to ensure that the workforce is adequately trained, deriving from unions' responsibility for the welfare of their individual members. It could be further argued that this responsibility extends to the vocationally formative years of members during which they have the right to the experience necessary to acquire relevant skills.

Another, and possibly more difficult issue to address is the varying educational abilities of students. Just as students have a range of on-entry experiences and levels of ability related to these, so they have a range of learning abilities. It should also be possible, however, to design a course so a more competent student can complete the course in less than the standard time in course contact hours.

Administratively, this could be enhanced by the cooperation of industry, especially when there are sufficient high achievers to compose a class. For example, given that TAFE enrols all persons apprenticed in a particular trade, if an employer (or a group of employers) hires sufficient higher achievers to constitute a class load, identifies these to TAFE and directs them to a particular college, TAFE could then accommodate them, as a group, in a more flexible course arrangement. That is to say, a streaming arrangement could be built out of cooperation between TAFE and industry.

Given the acceptability of these schemes, there is no apparent reason why another option cannot be provided: a Fast Track Apprenticeship involving both reduced contact hours and a reduced overall period of college attendance. We wish to stress that the endorsement of such an option should not function as a reason for reduced commitment by industry to formal paid release training. Rather, the hours "saved" in the first course could well be used to start a trade extension, or multi-skilling program. For example, an electrical apprentice might begin the Industrial Electronics course as a trade extension or might begin, with advanced standing, the Instrument Trade course, and so on.

Generalisability

The greater the generalisability of the contents of a curriculum, the greater its external relevance to the world of industry and commerce. Similarly, the greater the scope of any item in the curriculum (in its application to particular cases, tasks and skills which also need to be mastered), the greater the internal relevance of that component, and the greater the internal coherence of the curriculum.

A topic's generalisable aspects are of primary importance. Once these have been mastered, graduates are able to apply generalisable knowledge to novel situations. Generalisability of knowledge is demonstrated pragmatically in its transferability from the limited context of training to a variety of workplace contexts. This is a measure of external relevance.

Generalisability also has structural dimensions. The overall generalisability of a course lies to some extent in its structure, just as the generalisability of a topic or subject lies in the structure of the educational delivery of that topic or subject - most especially in the movement from general to specific and following the logical and psychological structure inherent in the subject material.

The generalisability of a course then, lies to some extent in the potential of the course structure for generalisability, for example in the establishment of core and elective subjects. The core subjects of a course represent the general base from which a wide range of specifics may be addressed. The specific group of electives selected by a particular student would then be those most relevant to his or her present vocational needs.

Generalisability of particular content or of the structure of curriculum could be transparent to students and, indeed, to those teachers who administer or "deliver" rather than develop curricula. They might not see the generalisability although they will benefit from it. To enhance consciousness of the presence and power of generalisability, the principle of proceeding from the most general feature of a given topic to the more specific cases must itself be taught explicitly and clearly.

Fast Track Apprenticeship courses were mentioned above as an example of a curriculum which would meet the necessary criteria of relevance, and meet them better than do the more standard curriculum models. Here there is a natural extension of the core plus elective model. The training time saved in any Fast Track model should be reallocated to alternative training packages, such as trade extensions programs or multi-skilling programs - the difference between the two being the degree of specificity of the program. There emerges here the possibility of developing a course which both continues down much the same path as the original trade course undertaken as a trade extension program and which ranges widely as a multi-skilling program. Trade extension is more vertical and multi-skilling more lateral. The extent to which electives are used to supplement core subjects in a given course blurs even this simple distinction.

Multi-skilling

There are likely to be relations between the skills required for various different trades, even though the range of skills crosses traditional trade boundaries. Obviously there will continue to be a variety of different skills packages on offer: the multi-skilling needs of petro-chemical industry trades may differ from the skills needs of construction industry trades. There will still be tradesmen who are essentially electricians, mechanical fitters and so on in each industry, and if they are all to be multi-skilled there will be a different skills package required for the multi-skilled of each industry. This need not be a significant problem for education/skills providers, since core subjects may be used to provide the general or common base of those skills which are fundamental (to an electrician, for example) in whatever industry - and these followed by industry specific electives.

We would argue that generalisability of skills is independent of multi-skilling in the sense of skills which transcend normal trades barriers - the most usual sense of "multi-skilling" in current use. In our view, existing (supposedly narrow) trades courses should present the material to be covered in a way which emphasises the general principle of the skill involved, and leads from that to the specifics.

As an example, take cutting tools, covered in many trades courses. Within each trade, emphasis should be given to the principle of cutting - the use of the wedge and the universal characteristics of the wedge should then be addressed, its mass at the point, its hardness, its cutting angle, and so on. In this way students would learn the characteristics necessary to make good, clean, efficient cuts. Provided students are aware of the characteristics of any new materials introduced into their trade area, they will be able to work competently with the materials in a short time, because they are aware of the general principles which apply to the specific skill.

Some progressive employers have recognised the need for formal skills training beyond the legislative requirements for existing trade training. ICI has led a number of companies into a multi-skilling program where all electricians are released on company time to fulfil the requirements of the Instrument Trades Course, and all instrument fitters fulfil the requirements of the Electrical Trades Course. Because of standard exemption arrangements between the courses, considerably less time is required than the simple sum of the hours of each course, but the off-the-job training commitment is still very much higher than for either trade taken alone. This program is a definitive example of multi-skilling. A wide range of outcomes is anticipated in this program, including: (i) that the company will have a workforce with fewer demarcation issues; (ii) that many problems associated with emergency breakdown call-outs will be overcome; and (iii) that the individual multi-skilled workers will benefit financially and in job satisfaction. This has significant implications for credentialling within TAFE.

Recognition of a worker's increased skill base could be a matter for the particular company providing (in some sense) the increased training. In-house training could provide the skills necessary to the company workforce, and the company could then recognise these in its staff classification and relevant pay scales. This gives one group a pay rise which is not generalised to all trades within the company. This procedure was used years ago by the Public Transport Commission in its reclassification of some electricians to equipment maintainers. An obvious problem here is the lack of recognition of such classifications in industry generally: because of this lack of portability of classification, difficulties will be encountered in arguing for an equivalence with other classifications in more general use in the industry. To ensure widespread recognition of completed training programs workers desire a credential, and unions should insist on this as one of the course outcomes. In the ICI example no credentialling problem exists, as the workers fulfil the requirements of recognised courses and receive the appropriate awards for those courses.

Some multi-skilling proposals are aimed at providing career path equity across trades. The content of these is not related to across-trades skill development as such, but rather to matters such as supervision and occupational health and safety. It is the intention of these programs that workers from all trades have equal opportunity to reach the higher supervisory levels now available to only a few of the trades for which post-trade training is provided. In our view such proposals should be seen as trade extension programs rather than multi-skilling. Their advocates may still seek paid off-the-job training in these areas even though the benefits in relation to industry efficiency seem much lower than for programs directed at increasing the range of work-face skills.

As noted earlier, industrial unions will need to accept some responsibility for ensuring adequate training, for discouraging unreasonable requests for attendance exemptions for a subject on behalf of students who may then encounter difficulties with assessments for that or following subjects. For similar reasons, given that TAFE as an independent body is providing sufficient places in appropriate courses, the unions might try to ensure that TAFE retains the bulk of the formal vocational training.

TAFE trades teachers probably represent the most extensive and longstanding example of multi-skilling. As self-employed tradespeople know, there is a significant difference between being a successful contractor and being a good tradesperson. Certainly, the one does not preclude the other, any more than it implies it. Different skills are necessary. The trade teacher, like the private contractor, has had to acquire and develop a set of entirely new skills. This is not to deny that like the successful contractor, the successful trade teacher will normally have been a good tradesman, and in each case may remain so.

To ensure high quality vocational training, it is necessary to ensure the development of the new skills necessary for effective teaching. TAFE provides a process of development and review of this skills development process. Here, as elsewhere, one needs to serve one's apprenticeship.

The views expressed in this paper do not necessarily reflect those of the NSW Department of TAFE.

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COLLECTING CASE STUDIES IN TAFE CURRICULUM : SOME PROBLEMS

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A small group of people working in TAFE curriculum research and development met in symposium at the AARE conference in Melbourne in 1986. We came from four different States and most had never met before. We had planned to get together at the conference to present reports on current projects and to discuss our work in the various TAFE Authorities. It was a way of expanding our own networks and of sharing ideas among ourselves, as well as letting other AARE members know about some of the activities going on in the TAFE sector.

The West Australian Social Science Education Consortium had earlier begun publishing a series of Australian Case Studies in Curriculum. We approached the general editors of the series, who were present at the conference, to explore the possibility of contributing a TAFE component to the series. The idea met with interest, assuming that more papers could be added to the collection and that the existing symposium reports could be redeveloped as publishable articles.

We need not dwell on the complexities of editorial responsibilities over the following two years, except to say that several more contributors joined the team making up the collection to eight papers from five States, and representative of a diversity of curriculum issues and research methods.

A topic raised by most of the contributors at various stages, concerned the nature of a case study. They needed to be reassured that what they were doing was able to be called a case study. Did the research need to follow a specific approach to be a case study? What was the difference between a case study and a descriptive report? Was it a useful approach to use? A second set of problems arose from the nature of TAFE curriculum research itself and the fact that the contributors were engaged in heavy and on-going practical workloads which gave them little time to analyse and fine-tune their work in the way academic researchers take for granted. The most valuable thing they had to offer were personal accounts taken from real experience, yet the ongoing demands of their activities made it difficult for them to focus on and complete a paper on a project which they wanted others to know about. It is these two issues we would like to explore in this paper.

The editors of the first two volumes of the Australian Case Studies in Curriculum series (Fraser 1985; Kennedy 1986) pointed to a need for more published material on practical activities in curriculum development and evaluation, especially in the Australian context. Case study research has always been slightly suspect in some sections of the research and evaluation community, and has been variously decried as subjective, non-conclusive and "wishy-washy". Theoretical investigations and "hard data" research into educational problems have tended to appear more attractive to journal editors, while studies of single situations have been deemed to be of limited general interest (Fraser 1985, ix). Hence, it is often difficult to locate reports on practical curriculum problems and solutions, at a time when it is becoming increasingly important in Australia for educationists and teachers to take on extra responsibilities as curriculum developers.

The case study approach, and the qualitative methodologies generally used with it, are not new in the social sciences. The techniques of observation, participant observation and intensive structured and unstructured interviews have been the methodological mainstay of particular theoretical positions within disciplines such as psychoanalysis, anthropology and sociology. Despite this longevity however, the case study approach has been overshadowed in the social sciences, particularly in the post World War 2 years, by more quantitative methodologies whose rationale and techniques are drawn from the natural sciences. As Middleton points out (1986, p2), this was despite the insistence of social scientists such as C. Wright Mills that the object of sociology was to "grasp history and biography and the relations between the two within society. This is its task and its promise."

Since the mid-1960s, however, the limitations, weaknesses and sometimes abuses of an uncritical use of quantitative methodologies have been widely debated in many fields of social enquiry (Hammersley & Atkinson 1983; Bhaskar 1974; Bell 1978; Keat & Urry 1975). The qualitative methodologies, often used in conjunction with the case study approach, are now commonly favoured by researchers working within interpretive or critical theoretical frameworks. These methodologies offer them greater opportunity to explore in a more holistic fashion the multifaceted and complex nature of social reality (Angus n.d.). Case studies and qualitative methodologies also appear more frequently in recent research in education (Ball 1984; Samuel 1983; Connell et al. 1982; Willis 1977) though as yet in Australia, and particularly in the technical and further education sector (TAFE), they represent only a small proportion of current research and evaluation designs.

An important consideration in the development of any research methodology is the elimination of bias. Both the positivist and naturalist traditions in the social sciences have argued that scientific objectivity, as a necessary precondition for arriving at the truth of a situation, is produced by the elimination of the potential for bias. Both traditions assume that this can be achieved by isolating a body of data so that it will be "uncontaminated by the researcher, either by turning him or her into an automaton, or by making him or her a neutral vessel of cultural experience" (Hammersley & Atkinson 1983, p14). A conceptual distinction is made between social science and its object of study, which in practice is embodied in the methodological prescriptions governing the nature of the relationship between the researcher and the researched. It is believed possible to reduce the potential for bias by developing an account of the situation under investigation which treats it as external to, or independent of, the individual conducting the research. This belief is based on two assumptions: that it is possible for a researcher to approach a research setting without preconceived theories or expectations regarding the outcomes of the investigation and, secondly, that the research subjects must remain objects, or targets, of investigation to the researcher, to prevent the introduction of bias through personal involvement. Relationships between the researcher and researched are viewed as possible barriers to scientific objectivity, rather than avenues through which to obtain a greater understanding of the elements of that which is being studied.

In contrast, qualitative methodologies and the case studies approach to research acknowledge that *some form* of relationship exists between researcher and researched, and that *some kind* of bias, whether it be personal, political or theoretical, is brought to the investigation by all those involved in its conduct. Research of this nature provides the opportunity to take the effect of these predispositions and relationships into account.

Case studies can also be seen as a way of addressing the problem of relevance, in the sense that they reflect what is really happening in all its personal and social complexity (Stake n.d., p4) rather than studying events in controlled, atypical, "laboratory" situations. However, this does not mean that the case study is merely the telling of a story, although "case stories" may well also be case studies. As a research approach it has a conceptual structure which presents an understanding of a situation, draws conclusions about it, and allows readers to extend these new insights into their own experience and awareness. It is important to realise that the case study is not a specific technique. As Stake emphasises, "... it is a way of organising social data so as to preserve the unitary character of the social object being studied" (n.d., p5). It "is the study of a 'bounded system' with a conception of *unity* or *totality*" (Stake n.d., p4; our emphasis) at the centre of the methodological concerns. The research methodology may be statistical or ethnographic; data gathering methods may be structured or unstructured; the analysis may be quantitative or interpretative. The case study sets out to focus on, and interpret, a part of reality which is considered to be significant to the researcher and to the reader.

The focus of our collection of papers was the development and evaluation of curriculum in TAFE. In a recent article entitled *Curriculum as Anthropology*, McLeod (1987) pointed to the distinction between what curriculum developers say they know, or the *ritual* of curriculum procedure, and how they act. Their actions are of far greater importance to the researcher than their plans and beliefs, because action is the indicator of meaning. "Given that action embodies meaning, the precise nature of that action becomes crucial in the understanding of curriculum" (p18). It is hoped that the papers will show that the case study approach gives researchers important access to the actions of curriculum developers, as well as to their statements about what they thought were the important "meanings" when they looked back analytically on their activities.

Case study research also takes into account the context of curriculum activity. Curriculum practitioners continually stress the fact that decisions rarely work out as planned (McBeath 1986). Political, economic and personal interaction become the reality of curriculum decision making, sometimes in clear contradiction to the ideals and intentions of the developer. Very little can be anticipated with certainty and the finished curriculum product is frequently full of surprises and hidden meanings (McBeath 1986). These characteristics are reiterated constantly throughout this selection of TAFE curriculum case studies.

Different approaches to case study methodology are obvious in this collection. Four of the contributors had been involved in curriculum research projects using formal research methods; two were evaluations of specific courses, one a study of user participation in curriculum development, and the other an analysis of co-operative development. Two others had been involved in practical projects as curriculum developers;

they were participants, rather than participant observers, and their papers are retrospective accounts of their experiences. Another critically reviews a problem in occupational analysis method and the other draws on a wide experience of case study involvement to identify the problem areas in general. The papers are case studies in Stake's wider sense of the interpretation of a bounded system, presenting understanding, drawing conclusions and allowing readers to internalize the experience and make it their own. The ultimate justification for a collection such as this is that the experiences of the writers will be used to widen and deepen the knowledge of those who need more confidence to embark on curriculum activities of their own.

To an inexperienced TAFE curriculum developer, case studies can provide reference points when developing new strategies or solving problems. They can become signposts, pointing out desirable or dangerous directions to be negotiated. Case studies can provide a fund of experiences which curriculum developers can dip into, picking out those they wish to share and use, adding depth to their own activities and increasing their confidence in making their own decisions.

The papers cover a diverse range of courses, topics and concerns. Some of the themes overlap; co-operative development, involvement of industry in development, need for flexibility in procedure and so on, but possibly the most striking features of the cases selected are that they are all so different and all emphasise different kinds of problems and solutions. All, furthermore, highlight completely different sets of issues which are considered important in TAFE curriculum development and which can usefully be shared.

A further observation, and the second problem we want to emphasize, is that much valuable curriculum work of a surprisingly high standard is going on in TAFE throughout Australia. The papers came from five TAFE Authorities: New South Wales, Victoria, South Australia, Western Australia and Queensland. They span virtually the whole process of curriculum development, including methodology, occupational analysis, design, materials development, dissemination and implementation and evaluation. Most of them deal also with management and procedural issues.

TAFE traditionally has been regarded as the Cinderella in tertiary education, and very little has appeared in curriculum literature to dispel this image. The TAFE sector exists in the popular mind as attending to the practical, the unsophisticated, literally the nuts and bolts part of tertiary education. Many educators are surprised to discover that, hidden beneath this humble image, there exists an army of experienced and successful researchers, planners and developers whose curriculum output exceeds that of any other educational sector. Over one million TAFE students across Australia are enrolled in possibly as many as 30,000 different subjects at any one time. These subjects are being constantly updated according to rapidly changing industrial, commercial, social and political demand. All have thus to be continually researched, developed and implemented. If reports of TAFE curriculum research and development are not often found in academic journals, it might be that curriculum developers are so busy meeting the demands of their workloads that they don't find much time to write about it! In fact, the editor of this collection had moved out of the TAFE sector before finding the opportunity to collect and edit these papers.

Also in popular mythology is the image of TAFE as an industrial trainer, concentrating steadfastly on the development of manual skills, carefully standardised and regulated by rigid behavioural objectives and mastery level achievement tests. The uninitiated might point to the ubiquitous Instructional Systems Model, controlling curriculum decision-making with its algorithms and check lists, and accuse it of producing a mindless stream of performance objectives, unrelated to educational aspirations or the quality of life. The enormous gap between popular belief and actual curriculum practice is laid bare in these case studies. While the *theory* of vocational curriculum development frequently emphasises a technological or linear approach to curriculum development and the typical syllabus found in TAFE colleges may display a prescribed rigid structure and format, practical case studies reveal that the structure and format of the finished product are probably the least, and last, of curriculum developers' concerns. The reality of curriculum decision-making, as the deliberationists have been pointing out for nearly two decades (Walker 1971; Reid & Walker 1975), is far more complex than working through a set check list of tasks to complete. The reality is more to do with the ideals and disappointments of developers, teachers, students and administrators, and their compromises with the restrictions of time, finance and the need to produce results. This is the reality that the curriculum student or the beginning practitioner must also face.

There is a lack of expectation in TAFE that important projects be analysed and written up for publication and public scrutiny. Internal report writing requires a different style of writing and format, and the extra time needed for crafting and perfecting a paper for publication is rarely available. Nor is there any reward for doing so. Thus it was with a sense of the ultimate usefulness of the case studies they were asked to write, that the contributors carried on in the face of practical difficulties and little support from the TAFE employing bodies.

The collection is now with the printers and we can only hope that the individual effort, time and emotion which went into the contributions will prove worthwhile. Their degree of worth will be judged on whether the collection can contribute answers to the two issues discussed in this paper. Their worth must be judged, firstly, on the extent to which they offer valuable experiences which can be shared usefully with other TAFE curriculum developers; and secondly, on the degree to which they help dispel some of the myths and enable the TAFE sector to be seen publicly as a valid part of the research and evaluation community, with a potential contribution as valuable as any other part of the tertiary sector.

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WORKSHOP D

Theme: Vocational Teacher Education.

Monday March 13. 3.30 pm; Friday March 17. 11.00 am.

Adelaide Room 1

Dr. N. Rainer Nyberg. Faculty of Education, Abo Academy, Vasa, Finland. *Teacher Motivation in Vocational Education: Causes and consequences.*

Dr. Grahame Peak. Principal Lecturer and Program Director, Institute of Technical and Adult Teacher Education, Sydney College of Advanced Education. *Recent Development in Training of Trainers for Vocational Education in Europe.*

Dr. Neal W. Prichard. Professor and Director, Vocational, Technical and Adult Education and International Education Internships, University of Wisconsin-Stout, USA. *Vocational Teacher Education: Research into practice.*

Dr. Cheng-Han Shieh. Associate Professor, Department of Industrial Education, National Taiwan Normal University. *Evaluation of the Inservice Education Ordinance and Programs for Industrial Vocational Teachers in the Republic of China.*

TEACHER MOTIVATION IN VOCATIONAL EDUCATION – CAUSES AND CONSEQUENCES

Rainer Nyberg, PhD,Vasa, Finland

International Conference 12-19 March, 1989, Adelaide, South Australia

The working achievement of an individual is dependent on both ability and motivation. Motivation – defined as a relatively permanent internal state closely connected with the initializing, energization and focusing of behavior – is in turn dependent on the individual´s needs and on different incentives. The incentives may consist of for example material or social rewards or punishments as well as so called "task-internal" incentives connected with, among other things, how one experiences the contents of the work. Motivation is also influenced by the cognitive processes of people, viz. their perceptions and expectations and their self-perceived efficacy.

A total of 164 teachers and 2263 students took part in the empirical part of the study which was carried out 1986-87 in nine vocational schools and institutes for Swedish speaking students in the province of Vasa, Finland. The main purpose of the study was a) to find out those causes/ determinants that influence work motivation among vocational teachers, b) to test the interrelations between work motivation and its causes/determinants and c) to study the interrelation between work motivation among teachers and its consequences – i.e. students´ experiences of teaching on the one hand and the students´ motivation on the other. The results to be described in this paper have been reported more extensively in a doctoral thesis (Nyberg, 1988).

The study was based above all on a motivation theory which integrates several features from different motivation theories of needs, incentives and cognitive expectations (Chung, 1977), as well as the self-efficacy theory (Bandura, 1977 and 1986). The secondary school reform in Finland is but one of the frame factors (Lundgren, 1977) that may have a connection with motivation among teachers. The reform has caused great changes in the activities and curricula of the vocational schools, and brought with it new expectations of the teachers and their teaching. Vocational teachers should no longer only convey knowledge and skills. They are also expected to add to the emotional development as well as the development of the personality of the students.

The empirical part of the study was partly exploratory and partly conducted with the aim of testing some hypotheses. It was supposed to answer the following questions: 1) How strong do vocational teachers consider their work motivation to be? 2) What determinants do the teachers consider important for their motivation? 3) What are the relations between motivation and its different determinants as perceived by vocational teachers? 4) What is the interrelation between the teachers´ self-perceived efficacy and their level of motivation? 5) What is the interrelation between the teacher´s level of work motivation and students´ experience of teaching and students´ motivation respectively?
The hypotheses were based on a hypothetical model and the above-mentioned theories and questions and touch upon the interrelation between teachers´ motivation, the determinants of motivation and students´ attitudes to teaching.

Methods

Both qualitative methods like interviews and questionnaires with open-ended questions and quantitative methods in the form of questionnaires with multiple-choice questions for teachers as well as students were used when collecting the data. The questionnaires to the teachers contained questions on their motivation, determinants increasing and lowering motivation, the teacher´s own experience of the effectiveness of his teaching, and 19 background variables. In the questionnaires administered to the students there were questions on some background factors, motivation for the subject and student evaluations of teaching.

In order to make it easier to survey the data when dealing with the results, the questions regarding motivation, its determinants and self-perceived efficacy of teaching were put together in larger groups, so called summed variables.These were formed on the basis of the factor analysis of the answers. In this way 193 single variables were reduced to 28 summed variables, the reliability of which varied between .64 and .93. The work motivation of vocational teachers can thus be described by three variables 1) *general work motivation* i.e. a feeling of comfort and satisfaction in work, 2) *growth motivation*, i. e. opportunities of taking responsibility and initiative and being creative, and 3) *status motivation*, i.e. esteem, appreciation, increased self-confidence.)

Results

The vocational teachers considered their motivation for work to be (on an average) between average and rather high.
Causes: The 39 variables that according to the teachers added most to *increasing* or keeping up the teachers´ motivation for work could be combined into seven summed variables. The vocational teachers felt that their motivation for work increases most by 1) Internal rewards, i.e. the teacher perceives that the students are curious, motivated, give positive feedback and develop into professionals, and the teacher experiences a feeling of success and usefulness, 2) Relations with the students i.e. to be able to be together with the students and teach and educate them, and 3) Self-actualization i.e. the work is experienced as a challenge, it is independent, intellectually stimulating and the teacher feels a need for developing. The variables 4) Relations with one´s colleagues and 5) Leisure time (private life) were considered to increase motivation to a lesser extent. The variables that to the least extent increased motivation were 6) Material conditions, i.e. the availability of rooms, equipment, teaching materials and the like, and 7) Opportunities for further studies, i.e. contact with professional life, opportunities for professional and in-service training.

The 38 variables that were experienced as *lowering* the teachers´ motivation could also be described as seven summed variables. The most serious ones were 1) Problems with students, i.e. that students are indifferent, not motivated, heterogeneous and disturbing, 2) The work load, and 3) Deficiencies having to do with teaching materials, rooms and equipment. The variables 4) Bureaucracy i.e. supervising of information and coordination in the administrative section, controlling and sticking to clauses and paragraphs as well as 5) Obstacles for development i.e. insufficient opportunities for in-service education and contact with professional life do not bring about a decrease of motivation as much as the previously mentioned factors do.

The variance in the motivation of vocational teachers is best explained by the variables 6) Experiencing insufficiency (14%, figure 1.) although according to the teachers, the variable did not belong to those that decreased motivation most. The summed variable called Inner rewards explained 11% of the variance in general work-motivation.

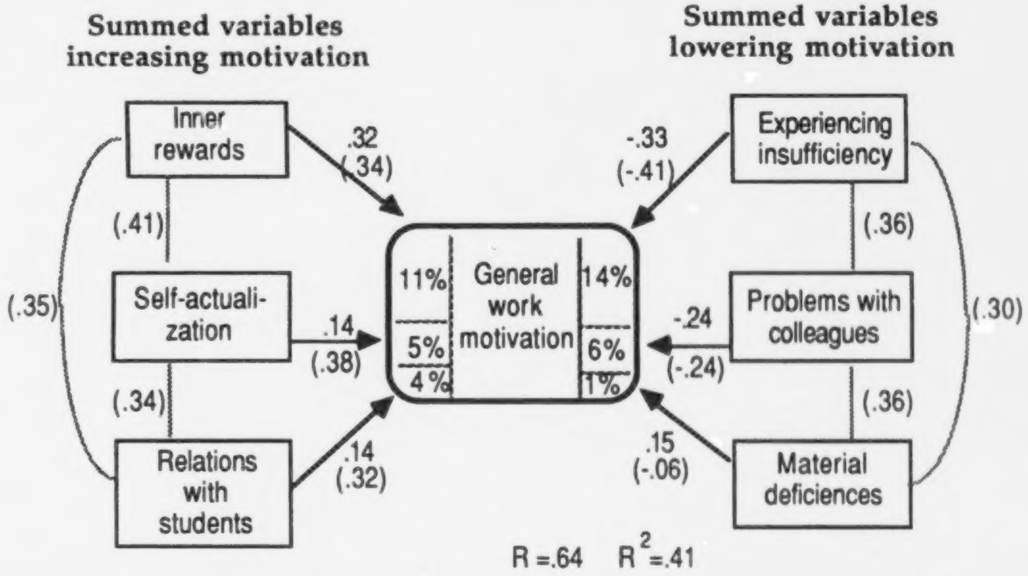
Summed variables increasing motivation
Summed variables lowering motivation
Inner rewards
.32
(.34)
(.41)
Self-actualization
.14
(.38)
(.35)
(.34)
Relations with students
.14
(.32)
11%
5%
4%
General work motivation
14%
6%
1%
Experiencing insufficiency
-.33
(-.41)
(.36)
Problems with colleagues
-.24
(-.24)
(.30)
(.36)
Material deficiences
.15
(-.06)
R =.64 R^2=.41

Figure 1. Percentage of general work motivation of teachers explained by different summed variables. Beta coefficients outside and correlation coefficients within brackets.

The level of general work-motivation was also significantly related to Self-actualization, Problems with colleagues, and lack of material. Generally speaking those variables that influence internal motivation were more strongly related to the level of motivation than external – for example material – factors. *Self-perceived efficacy* of teaching was measured with five summed variables, based on the teachers' self-evaluations of their teaching. General motivation for work correlates positively with the teachers´ own experience of their teaching effectiveness as far as Activating and Social relations ($p < .001$), Clearness ($p < .01$) and Feedback ($p < .05$) are concerned. This means that teachers who have a more positive view of their own teaching – high self-efficacy – also are generally more motivated than teachers with a low self-perceived efficacy of teaching.

Consequences: The second aim of the study was to investigate the relation between the attitude of the students to the teaching and the motivation of the teachers. Significant correlations were noted between two measures of the teachers´ motivation for work and the students´ experiences of the teaching. Those teachers who experienced a high *Growth-* and *Status-motivation* were considered by the students to teach considerably better.

On the basis of earlier research, positive correlations were also expected between the teachers´ work motivation and the students´ motivation. The fact that such correlations could not be noticed is supposed to depend partly on the design of the students´ motivation scale.

Discussion

High teacher motivation and positive student experiences of teaching were considered by some teachers to be a "good circle" (fig. 2), since a motivated teacher adds to the student´s positive experiences of teaching, something that may lead to increased positive feedback from the students.

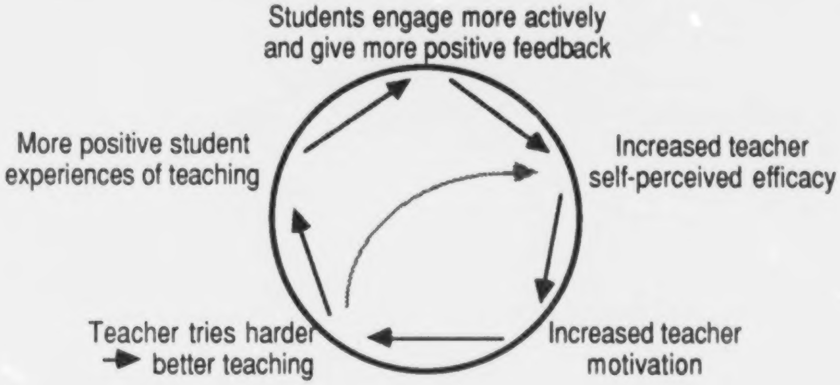
Students engage more actively and give more positive feedback
Increased teacher self-perceived efficacy
Increased teacher motivation
Teacher tries harder → better teaching
More positive student experiences of teaching

Figure 2. The "good circle" of teaching. Teachers´ self-efficacy and motivation interact with teaching performance and student feedback.

Self-perceptions of efficacy both *affect* performance and are *affected by* others´ perceptions of a persons efficaciousness (Darling-Hammond, Wise & Pease, 1983, 315). Thus it may be concluded a) that students´ experiences of the teaching influence the teachers´ self-efficacy, and b) that positive feedback from students will strengthen this effect on teacher self-efficacy and motivation.

In this study the teachers´ perceptions of self-efficacy showed significant correlation with their motivation. Therefore it seems meaningful to take into account self-efficacy in studies of teacher motivation and teaching behavior. In addition to the teachers´ self-evaluations of their teaching it would be preferable to separately measure the efficacy expectations and outcome expectations of the teachers. A closer analysis of the relations between the teachers´ motivation and the students´ motivation could also be useful. A more reliable scale should then be used to measure the students´ motivation and the situational motivation should be measured instead of a general (longitudinal) motivation.

It would be important to learn more about the measures that could be taken to increase the teachers´ motivation for work and improve the quality of teaching. When planning such development programs it is important to cooperate with the parties concerned and adjust the measures according to the needs of the teachers and the opportunities for schools to correspond to the teachers´ expectations. Some teachers may, for example, need help to be able to build up a stronger feeling of competence and self-efficacy (McKeachie, 1982).

Theories and research about the factors that influence teaching and the self-efficacy and motivation of students may give researchers a better understanding of, and also the administrators´ a greater sensitivity to the factors that influence teachers and students. It would thus be important to develop and test theories and models of motivation that to a higher degree take into account the specific factors of the school environment, the interaction between teachers and students and the frame factors that have an impact on both teachers and students.

The study described has led into further research in vocational education. A *new study* will consider student motivation and learning rather than teacher motivation. According to Pintrich (1987) there seems to be a dynamic interplay between motivation and various cognitive and metacognitive components in the students. The new study will concentrate upon the relation of teaching and learning to the students´ self-perceived efficacy, motivation and learning strategies, and how the motivation and learning strategies could be improved. The theoretical background of the study has been described in a report (Nyberg & Ruohotie, 1988). Since the use of computers is increasing in many occupations and in vocational education, the study will give special attention to teaching and learning computer literacy. Data will be collected during 1989 using interviews and questionnaires. Action research will be applied to improve teaching and learning.

My impression is that we have not done enough to improve the teaching and learning of tomorrow´s skilled workers. That is the most important reason to continue research in vocational education. As I see it, there is no use in studying teaching and learning if we do not want to improve each one of them.

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VOCATIONAL TEACHER EDUCATION:

RESEARCH INTO PRACTICE

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In 1918, Henry Ford had all but perfected his assembly line and was turning out Model-T cars for an increasingly mobile America. The United States was entering World War I, and factories adopted Ford's assembly line technique to produce goods for the war effort.

At the same time, one of the country's first vocational education teacher training programs began at the Stout Institute of Manual Arts in Menomonie, Wisconsin. The interesting thing is that through the years, as mass-production and assembly line techniques have been adopted by many institutions in an effort to deal with increasing numbers of students, the vocational education teacher education program in Menomonie has remained traditional, looking at each applicant as an individual, and creating one-of-a-kind programs to fit each student's needs and goals. Although the university offers programs that prepare students for work in the most modern industries, its approach is decidedly traditional with some unique characteristics -- and it works.

Introduction to UW-Stout

An introduction to what is today the University of Wisconsin-Stout (UW-Stout) is necessary to fully understand how this program assists students, and especially international students, realize their goals. UW-Stout is recognized as a special mission university. Its programs are unlike those offered in other universities in the state of Wisconsin. In addition to classroom work, students are exposed to experiences in their chosen field of study through an extensive network of labs, internships and other work opportunities. In addition to its program to prepare instructors in vocational, technical and adult education, UW-Stout is one of few universities in the United States offering a Training and Human Resources Development program.

Three types of students are served in the vocational, technical and adult education program. The first group includes traditional American students who are enrolled full time in the university. The second group is comprised of approximately 130 adults who are working full time and are enrolled in the university through an outreach program. These professionals rely on the university for summer, weekend, evening, and correspondence classes they need to become or remain certified as vocational education instructors. The third group, the international students, is the most diverse. UW-Stout serves approximately 60 students from more than five countries. International students typically remain at UW-Stout for one or two years to earn their Bachelor of Science degree, returning to their native lands to assume teaching and administrative positions.

In many universities, students are assigned an advisor within their department when they begin school. Depending on the individual, the advisor may be the students' personal advocate, or may be a virtual stranger who simply signs the students' registration forms each semester. At UW-Stout, students are assigned to work with the program director. Since the program director is involved with planning and curriculum development, what students get is a one-person source of advice, information, and assistance. In the vocational, technical and adult education program, the system allows a three-stage approach to helping students get the most out of their program at UW-Stout: assessment, prescription, and application.

Assessment Phase

UW-Stout is the only university in the United States using Student Occupational Competency Achievement Tests (SOCAT) to determine international students' abilities before they begin their program of study. The National Occupational Competency Testing Institute, formed in 1973, provides a standard, objective measure of vocational competency in more than 65 occupations (see Attachment One - NOCTI, 1988). The university is assembling the results of its testing, to provide a more in-depth analysis of the skills students bring to the program from their native lands.

Prescription Phase

When the program director receives the results of the written examination, he and the student use a plan sheet to create the student's program, (see Attachment Two). Together, they discuss the student's goals, and determine what technical, professional and academic courses the student needs to meet those goals. Students may transfer in as many as 93 credits from other institutions, toward completion of the 130-credit program. These are usually the general requirements, electives and some technical courses. It is here, in the prescriptive portion of the process, that UW-Stout differs the most from the assembly-line model. Each plan is different, because each student comes to the university with different experiences, preparation and goals. The candidates usually need to update their education and training competencies and sharpen up their technical skills. The plan is a contract, signed by both the program director and the student.

The vocational, technical and adult education program relies heavily on advice and input from private industry, vocational and technical institutions, and an advisory committee to keep its courses realistic and current. In addition, the program director meets periodically with representatives of the 16 technical colleges in the state, for information on the industries the colleges serve and the programs the colleges offer.

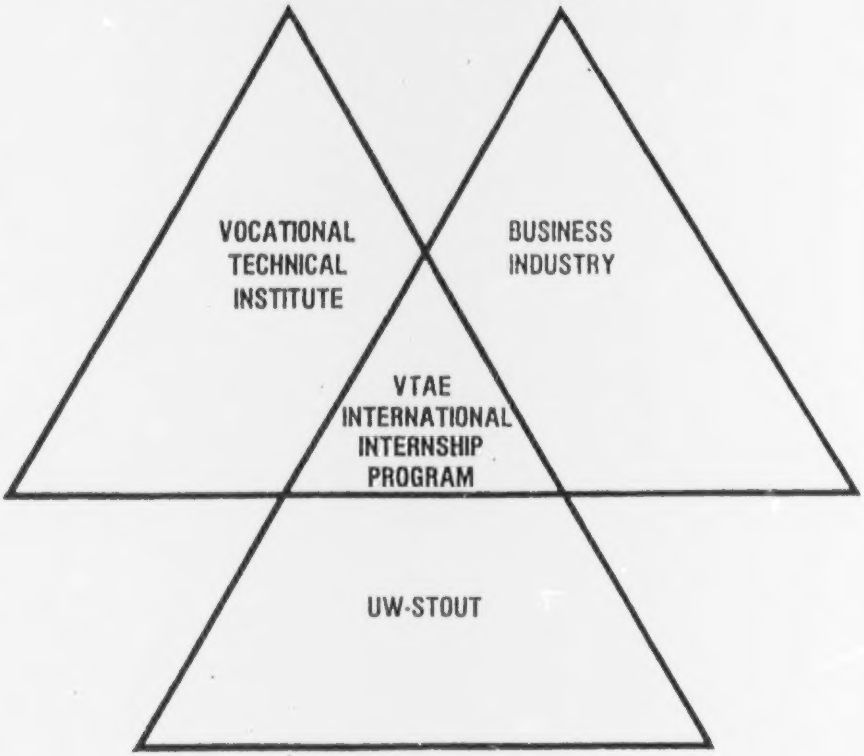
Application Phase

The program also relies on the technical colleges and industry for the Cooperative Internship program for international students (Prichard, 1987). The program is highly recommended to give students an opportunity to apply those skills they have learned in the classroom. Through a unique cooperative effort on the part of the university, the technical college and industry, students receive a semester-long cooperative work experience in both industrial/business and educational settings related to their field of study.

Toward the end of students' degree program, they may be assigned to work with an instructor at a technical college. The students are able to see educational principles applied as they assist the teacher with instruction and other activities. If the students will be entering administrative work when they return home, they will also have the opportunity to shadow supervisors, curriculum development personnel, or other administrators. Through the technical college and UW-Stout, the students are then assigned to work in an industrial or business setting, again employing the skills they learned at UW-Stout. Employers benefit from delegating tasks to the intern, freeing highly paid employees from time-consuming yet essential tasks. Students benefit by applying their learned skills in an actual work setting.

Although the approach demands more of the program director's time, it's worth it.

UW-STOUT'S VOCATIONAL TECHNICAL AND ADULT EDUCATION (VTAE) INTERNATIONAL INTERNSHIP PROGRAM


VOCATIONAL TECHNICAL INSTITUTE
BUSINESS INDUSTRY
VTAE INTERNATIONAL INTERNSHIP PROGRAM
UW-STOUT

Summary

International students enrolled in UW-Stout's vocational, technical and adult education training program receive individual assessment of their skills and competencies. Based on their abilities and goals, they receive an individualized program of instruction. They have the opportunity to apply their new skills in an actual work setting. A training plan is developed for each candidate similar to the position they will encounter upon graduation. The assessment, prescription and application process is known by teacher educators but is not found in the university setting. The results of the program can be seen all over the world.

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ATTACHMENT ONE

Student Occupational Competency Achievement Testing (Tests Available)

Accounting/Bookkeeping
Agriculture Mechanics
Appliance Repair
Architectural Design
Audio-Visual Communications
Auto Body
Auto Mechanics
Baking
Building Construction Occupations
Building Trades Maintenance
Business Data Processing
Cabinetmaking
Carpentry
Child Care Services
Commercial Art
Commercial Foods
Computer & Information Sciences
Computer Programming
Construction Electricity
Construction Masonry
Dental Assisting
Diesel Engine Mechanics
Diversified Occupations
Drafting
Electrical Construction & Maintenance
Electrical Occupations
Electronics
Electronic Technology
Food Production, Management & Services
Forestry Products & Processing
General Drafting & Design
General Merchandising
General Office
General Secretarial
Graphic Arts
Health Assisting
Heating & Air Conditioning
Heavy Equipment Maintenance & Repair
Home Entertainment Equipment Repair
Home Health Aide
Horticulture
Industrial Electricity
Industrial Electronics
Machine Trades
Marketing & Distribution
Mechanical Drafting
Medical Assisting
Nursing Assisting
Plumbing
Practical Nursing
Production Agriculture
Refrigeration
Sewn Products
Small Engine Repair
Truck & Bus Mechanics
Warehousing Services
Welding

University of Wisconsin-Stout
School of Industry & Technology

June 1, 1988

Student ______________________
Student No. ______________________
Date of Program ______________________

BACHELOR OF SCIENCE IN VOCATIONAL, TECHNICAL AND ADULT EDUCATION

(For Teaching in Post-Secondary Technical Colleges or Industry)

(1)

General Requirements	Credit* H	P	A
326-101 English	3		
326-102 English	3		
326-___ Writing Elective	3		
391-100 Speech	2		
391-___ Speech Elective	2		
355-120 College Math I	4		
OR 355-121 College Math II	4		
355-123 Finite Math	4		
OR 199-580 CAI in VTAE	2		
354-141 Comp Prog. - Basic	2		
479-110 Psychology	3		
OR 150-600 Org. Leadership	3		
479-582 Human Resource Mgmt.	3		
* OR 366-101 Health Survey			
366-340 First Aid & Safety	1-2		
387-110 Sociology	3		
320-201 Economics	3		
* OR 375-210 Government	3		
338-___ History Elective	3		
Science (One lab required) Biology Chemistry Physics	8		

Minimum General: 47-48

(2)

Professional Education:	Credit* H	P	A
190-405 Curr. Dev. I/E	2		
190-205 Methods Teach. I/E	2		
190-406 Inst. Eval. I/E	2		
198-550 Intro. to Training	2		
199-502 Principles VTAE	2		
199-534 Task Analysis	2		
199-674 Adult Education	2		
421-303 Ed. Psych.	2		
421-536 Work. with Cult. Diff.	2		
413-501 Intro. to Guidance	2		
120-560 Audio Visual Comm.	2		
190-408 Student Teach I/E	8		

Total Professional Ed.: 30

Electives (10-11)	Credit* H	P	A
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MINIMUM TOTAL OF ALL CREDITS: 130

(3)

Technical Requirements	Credit* H	P	A
Courses from 110, 130, 170)			
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Minimum Technical: 42

*Credit: H - Sem. hrs. of course
P - Date you plan to take course
A - Record cr. earned/transferred

Distribution of copies:
1 - Registrar 2 - Student
3 - Program Director

Student ______________________ Date __________
Program Director ______________________ Date __________
Dean ______________________ Date __________

ATTACHMENT TWO

Side Two

PROGRAM REQUIREMENTS

This four-year program for the Bachelor of Science in Vocational, Technical and Adult Education requires 130 semester credits. A maximum of 72 semester credits can be transferred to this program from a two-year institution. Transfer students earning this degree must complete a minimum of 32 semester credits from UW-Stout.

File application for admission to teacher education at the completion of 10 credits of professional education courses. See your advisor for the application.

ELECTIVES IN GENERAL STUDIES

Writing Elective: Select one of the following courses:	326-515	Technical Writing	3 credits
	326-347	Critical Writing	3 credits
	326-320	Business Writing	3 credits
Speech Elective: Select one of the following courses:	391-512	Speech Skills for Educators	2 credits
	391-508	Speech Skills for Business & Industry	2 credits
	391-200	Persuasive Speaking	2 credits

History Elective: Select any (3 credit) history course with a 338- prefix.

ELECTIVES

Multiple options are available to the student in the utilization of elective credits. Through advisement, the student may select the following alternatives:

1. 199-589 Internship in Training and Human Resource Development (8 credits) is suggested for electives.
2. Minor in a teaching or non-teaching field.
3. Use credits for free electives from any school.

CHANGES IN A FILED PROGRAM PLAN

1. Due to a unique or special circumstance, a change in the required portion of the program (printed on the sheet) may be in order. All inquiries concerning such a change should be directed to the program director. All official changes will be recorded on a waiver sheet or memo, and filed with the registrar for graduation check-out accuracy.
2. Changes made in the elective portion of the program are to be approved by your program director. All changes are to be made by your program director to the registrar for graduation check-out accuracy.

EVALUATION OF THE INSERVICE EDUCATION ORDINANCE AND PROGRAMS FOR INDUSTRIAL VOCATIONAL TEACHERS IN THE REPUBLIC OF CHINA

Cheng-Han Shieh
Associate professor in industrial education
National Taiwan Normal University
R. O. C.

BACKGROUND

Inservice education in Taiwan for industrial vocational teachers has not been completely effective. The capacity of inservice programs is insufficient (Yang, 1983; Hwang, 1985), and these programs are often ineffectively administrated (Ho, 1982; Ministry of Education [MOE], 1984a; MOE, 1985). There are administrative and individual difficulties that prevent teachers from attending inservice education (MOE, 1984a; MOE, 1984b; Shieh, 1985). To resolve these problems, the Ministry of Education in the Republic of China issued the Inservice Education Ordinance for Elementary and Secondary School Teachers (hereafter referred to as the Ordinance) in 1985. The Ordinance has several significant aspects: it is the first statute regarding teacher inservice education, and some important elements of inservice education, such as the types and providers of inservice education, are explicitly identified. The Ordinance, however, fails to address several problems. Concerned with only elementary and secondary school teachers, it does not address the unique needs of special groups, such as industrial vocational teachers. Because of these shortcomings, it is necessary to explore the attitudes of industrial vocational teachers and administrators toward the Ordinance and to trace its implementation and effectiveness in order to recommend amendments to the Ordinance.

STATEMENT OF THE PROBLEM

The purpose of this study was to evaluate the Ordinance to improve inservice education for industrial vocational teachers in Taiwan. Four questions gave direction to this study:

1. How has the Ordinance been implemented?
2. What are the attitudes of school administrators and teachers regarding the effects of the Ordinance on teachers' participation in inservice education?
3. What kinds of inservice education systems are preferred by school administrators and teachers?
4. How can changes in governmental policy improve inservice education for industrial vocational teachers?

RESEARCH HYPOTHESES

This study was basically descriptive. Previous research indicated that conflicts between administrators and teachers had affected teachers' participation in inservice education (Johnston & Yeakey, 1977). Therefore, two hypotheses related to the second and third research questions, respectively, were tested:

No 1: There are no significant differences between administrators' and teachers' mean attitude scores toward the effects of the Ordinance on teachers' participation in inservice education.

No 2: Administrators' and teachers' preference frequencies on inservice education delivery systems are homogeneous.

METHODOLOGY

The Instrument: To answer the aforementioned research questions, the researchers developed a survey instrument, consisting of three sections:

Section I: Demographic data and personal information, such as the subjects' school type, and school location.

Section II: Information regarding the kinds of inservice education preferred by school administrators and teachers. This section included four multiple-choice questions about three topics (see Table 1).

Section III: Information regarding the attitudes and opinions of the subjects about the Ordinance. This section was a Likert-type attitude questionnaire containing 28 questions which addressed seven issues (see Table 3).

Populations and sample: One segment of the population surveyed consisted of all school principals (195) and directors of academic affairs (195) in industrial vocational schools in Taiwan. 5567 full-time industrial vocational teachers who were teaching occupational courses comprised the second population. Ten percent (556) of the teacher population was selected as the sample. The administrator sample consisted of 374 administrators including 187 principals and 187 directors of academic affairs.

DESCRIPTION OF THE DATA

Administrators and teachers differed very little in their attitudes and opinions about the Ordinance and inservice education delivery methods. Chi-square tests of the responses in Section II of the instrument revealed homogeneity between administrators and teachers (see Table 1)

Table 1 Designers of Inservice Education Curricula

Item	Administrator %	Teacher %	Total %	Sig. .01
1. Curriculum specialists	57.7	41.7	47.4	*
2. Representatives of teachers	44.6	60.2	54.6	*
3. Principals and directors	43.8	33.5	37.2	*
4. College instructors	41.2	35.8	37.8	No
5. Governmental administrators	14.2	6.9	9.5	*

For designers of short-term inservice education curricula, items selected by administrators were curriculum specialists, representatives of teachers, principals and directors, college instructors, and governmental administrators, ranked in order according to the proportion of respondents selecting the relative item. In the teacher respondents, the items were representatives of teachers, curriculum specialists, college instructors, principals and directors, and governmental administrators. (see Table 1)

Concerning time period for conducting inservice education and reasons for attending inservice education, teachers believed that summer vacation was the best time period to offer inservice education, and that the next most opportune times were weekends and Sundays. They chose "to improve knowledge and skills for instruction" as the strongest reason to attend inservice education.

Table 2 MANCOVA of Differences in Mean Attitude Scores
(A) Wilks Multivariate Tests of Significance

Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
.96407	3.90781	7.00	734	.000 *

(B) Univariate F-tests (DF=1, 740)

Var.	SSb	SSw	MSb	MSw	F	Sig. of F
A	3.207	227.475	3.207	0.307	10.432	.001 *
B	0.085	205.611	0.085	0.278	0.305	.581
C	0.464	211.962	0.464	0.286	1.620	.204
D	0.968	325.060	0.968	0.439	2.203	.138
E	1.710	361.239	1.710	0.488	3.503	.062
F	2.096	235.594	2.096	0.318	6.584	.010 *
G	1.360	374.534	1.360	0.506	2.687	.102

R^2 (A)=.0139 R^2 (F)=.0088

Use of MANCOVA to analyze the responses in Section III of the instrument revealed that there were no meaningful differences between administrators and teachers. The first research hypothesis was accepted (see Table 2-3).

Respondents only gave positive scores (slightly more than 3.0) to Issues B and A. This indicates the subjects had slightly positive attitudes toward the incentive policies and the implementation of the Ordinance. The scores of Issue C, D and G were very close to 3.0, indicating that neither groups had strong feelings toward the relations between the teacher's priority to attend inservice education and his or her seniority, the implementation of the teaching certificate renewal policy, as well as how the Ordinance had influenced teachers' participation in inservice education. The mean scores of Issues E, and F were less than 3.0, especially

Issue E, indicating the subjects expected that inservice education should be mandatory, and that the government should bear the expenses of inservice education. (see Table 3)

Table 3 Differences of Adjusted Grand Means to 3.0 (No Opinion) and Adjusted Mean Scores on Each Issue

FACTOR	Adjusted Grand Mean	Difference (AGM-3.0)		Adjusted Mean
Variable .. A	How has the Ordinance been implemented?			
			Administrator	3.381
	3.245	+0.245	Teacher	3.169
Variable .. B	How do the subjects respond to the incentive policies of the Ordinance?			
			Administrator	3.363
	3.385	+0.385	Teacher	3.397
Variable .. C	How has the Ordinance influenced teachers' participation in inservice education?			
			Administrator	2.773
	2.824	-0.176	Teacher	2.853
Variable .. D	Should the teacher's priority to attend inservice education be determined by seniority?			
			Administrator	2.891
	2.957	-0.043	Teacher	2.993
Variable .. E	Who should pay for inservice education: the government or the teacher?			
			Administrator	2.515
	2.416	-0.584	Teacher	2.361
Variable .. F	Should inservice education be mandatory?			
			Administrator	2.514
	2.624	-0.376	Teacher	2.685
Variable .. G	Should the teaching certificate renewal policy be implemented?			
			Administrator	2.802
	2.890	-0.110	Teacher	2.939

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Several conclusions are drawn from the findings of this study:

1. Administrators and teachers differ very little in their attitudes and opinions about the Ordinance and inservice education delivery methods.

2. The subjects have no strong feeling about the Ordinance.

3. The respondents have slightly positive attitudes toward the implementation of the Ordinance.

4. Administrators and teachers believe that the effectiveness of the Ordinance's incentive policies is adequate.

5. Similar delivery methods of inservice education

are preferred by school administrators and teachers. They believe that teachers who desire to attend the program, curriculum specialists, school administrators, and college instructors should be involved in planning the curricula of short-term inservice education programs. According to the respondents, summer vacations, weekends and Sundays are optimum times to offer inservice education programs. Improved knowledge and skills for instruction is the major reason teachers list for attending inservice education. According to the respondents, the government should pay costs of inservice education.

Recommendations

Based on the findings and conclusions of this study, the investigator makes the following recommendations:

1. The following policies should be incorporated into the Ordinance to strengthen its effects on teachers' participation in inservice education: a) The amount of money budgeted for inservice education should be stated explicitly; b) The government should pay all costs needed for short-term and teaching-related inservice education; c) Policies for rewarding the providers of inservice education should be added to the Ordinance; and d) Standards for rewarding teachers who engage in inservice education should be established.

2. Since this study was conducted only two years after the announcement of the Ordinance, the investigator recommends continuous evaluation of the Ordinance.

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WORKSHOP E

Theme: Improving opportunities for student retention and progress.

Monday March 13. 3.30 pm; Friday March 17. 3.30 pm.

Adelaide Room 2

Dr. Frank Sofo. Canberra College of Advanced Education. *Apprentices' Literacy Skills.*

Dr. Roger Atkinson. Senior Education Officer, External Studies Unit, Murdoch University. Ms. Clare McBeath, Curtin University of Technology. *TAFE to Higher Education: Pathway to mid-career upgrading.*

Dr. Christopher Parkin. Director, Centre for Research in Further and Higher Education; Head, School of Science and Mathematics, Bedford College of Higher Education, United Kingdom. *Student Withdrawal from Part-time Courses of Further Education.*

Dr. Roger Atkinson. Senior Education Officer, External Studies Unit, Murdoch University. *Regional Colleges: Resource sharing between vocational education and higher education.*

Dr. K.C.S. Jain. Reader in Commerce, Regional College of Education, Ajmer, India. *Improving the Quality of Vocational Education.*

APPRENTICES' LITERACY SKILLS

Dr Frank Sofo, lecturer

Abstract

Specially designed VOcational REference LAnguage TEsts (VORELATE) were validated in accordance with the Developmental Model of Literacy (Sticht et al, 1974, 1982). They are adult orientated tests and include an innovative component on graphic literacy generally not found in other literacy tests. The purpose was to compare the listening comprehension and reading comprehension abilities of 194 apprentices in the areas of prose comprehension, vocabulary knowledge and graphic literacy in relation to progress through their job training materials. It was concluded that the VORELATE could be adequately utilized for the identification of "at risk" apprentices, since those scoring in the lowest quartile on the Prose and Graphics subtests were not making adequate progress and would not complete their apprenticeship training within the prescribed time. The long term implication was that apprentices low in literacy skills who were not taught independent reading skills would remain "at risk" in terms of their vocational training and also in terms of their future functioning within the work situation.

Introduction

A major concern to TAFE training institutions and to employers, has been the literacy requirements of apprentices, not only from the point of view of adequacy for job training but from the viewpoint of developing independence in order that once trained they can cope with new problems related to their employment. The distinction between developing functional competency for minimum job performance and of adequate literacy skills for maximum job performance, is crucial to the quality of opportunities given to trainees.

An analysis was conducted of the literacy skills of apprentices in relation to their rate of progress through their vocational training modules. The relative efficiency of listening and reading was investigated in relation to prose comprehension and graphic literacy. It was possible to identify students with poor literacy skills and to discriminate among them so that apprentices with poor oral language comprehension skills could be distinguished from those with relatively well-developed oracy skills but who primarily had a literacy (reading-writing) problem.

The concern was not so much whether reading and listening abilities related to job proficiency, but rather how they related to the training program, that is, knowledge and concept acquisition relevant to a particular skilled trade. Fully trained workers must be able to perform the types of tasks relevant to their job. If new or modified tasks arise or if forgotten knowledge needs to be recalled, workers would have the option of reading how to do the task or of asking or observing a colleague. If workers did not have the literacy skill necessary to learn or recall the task, then their options would certainly be limited and their

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efficiency diminished. The concern was with the training of apprentices and the implications of this for qualified workers.

It was thus possible to identify apprentices who were able to learn through observation and listening, but not as efficiently by reading, and those who were probably experiencing difficulty learning by listening and observing as well as by reading.

Instrumentation: *Pilot Studies and Design*

Two main pilot studies were conducted in the test construction stage and the calibration study demonstrated the equivalency of the parallel forms A and B of the VORELATE. Because this equivalency was demonstrated, the design of the major study produced both a study and a replication within the study. Data from the equivalent forms of the VORELATE produced very similar results which enabled firm conclusions to be drawn. Further, the similar pattern of results between the two forms of the VORELATE also served to strengthen their equivalency.

The sample in the study consisted of 194 male motor vehicle mechanic apprentices enrolled in levels one and two within an Australian TAFE College. A self-paced criterion-referenced modularized mastery system of instruction was in operation and very accurate records were maintained within the computerized system available for tracking progress. All apprentices were administered the Literacy Assessment Battery (LAB) first and on the basis of these scores they were divided into quartiles so that their performance on the VORELATE subtests would help answer the four major questions posed.

Results and Discussion

Question 1

Is the listening ability of the automotive mechanic apprentices more efficient than their reading ability?

The data indicated that the definition of literacy skills greatly influenced the direction of results. For all apprentices, when listening and reading ability were regarded as the combined Prose and Vocabulary VORELATE scores, conflicting results emerged. Listening and reading abilities were not significantly different in considering the results of forms A and B separately for uncorrelated samples. However, in the second case of combining scores, a larger sample size (n = 194) and a more sensitive t-test for correlated samples, produced a significant difference between listening and reading abilities on the Graphics subtest, were not significantly different. Therefore the first set of results indicated that the elements of comprehension such as Prose, Vocabulary and Graphics, should be considered separately.

As a group, therefore, apprentices' abilities in listening and reading, differed significantly in two types of materials, Prose and Vocabulary but not in the third type Graphics. In the case of the Prose subtest, apprentices' listening comprehension was superior to their reading comprehension. However, in the case of the Vocabulary subtest, reading comprehension was significantly more efficient than listening comprehension. There was no significant differences in listening and reading in relation to the Graphics subtest.

Question 2

Does it make a difference whether automotive mechanic apprentices read or whether they listen with respect to prose when their literacy performance on the Literacy Assessment Battery (LAB) is in the lowest quartile?

A second major result indicated that it was erroneous to consider the literacy abilities of apprentices generally as one homogeneous group. An examination of the results by quartile indicated different outcomes for all three subtests.

For the Prose subtest, all analyses showed that quartiles one and two did not differ in listening and reading comprehension skills, while quartiles three and four possessed high reading potential, that is, significantly superior listening comprehension skills. Therefore, the study indicated that apprentices considered as groups were either mature readers or possessed high reading potential.

Although the Developmental Model allows for a Low Reading Potential category, this study uncovered few apprentices who did not fit into two classifications of mature readers and persons with reading potential.

The answer to the second question, therefore, is that, in relation to prose, apprentices in the bottom quartile listened more efficiently than they read.

Question 3

Does it make a difference whether the apprentice read or whether they listen and read with respect to graphics when their literacy performance on the LAB is in the lowest quartile?

For the Graphics subtest, all analyses showed that all quartiles performed equally well in both modalities. The poorest readers did not perform any higher in the Graphics subtest when an audio support was provided. This result needs to be considered in relation to the results of the other questions. The lowest readers, the fourth quartile group of apprentices, had a mean performance in the Prose subtest which was significantly higher in the listening modality than in the reading modality.

Since both the Prose and Graphics subtests measured the same auding ability, it would be unlikely that the visual stimulus in the Graphics subtest would diminish the listening ability to the level of the reading ability. Therefore, it would seem that while the listening component did not add to the performance of reading graphics, the graphs themselves enabled apprentices to close the gap between their listening and reading comprehension abilities displayed in the Prose subtest. Even though performances between the Prose and Graphics subtests cannot be directly compared, the conclusions offered would appear reasonable. The graphs themselves, which are specifically another signalling system for prose, enabled apprentices with poor literacy skills to close the gap between their reading and auding abilities. Therefore print in the form of graphs facilitated reading comprehension.

The answer to Question 3, therefore, is that apprentices were able to comprehend as well by reading as they could by listening and reading with relation to graphics. This was true not only for quartile four, but for all apprentices in the study. This is an important result of the study since the visual display (graphics) did for the readers in the Graphics subtests what the audio displays (speech) did for the poorest readers in the Prose subtests. The question raised, therefore, is: What do speech and graphics have in common?

Perhaps one explanation lies in the fact that the ability to interpret concrete visual objects develops very early, as does speech ability. Both develop very early in life and are a prerequisite to learning to read words and less concrete visual displays. In so far as graphics resemble concrete visual objects which a child learns to interpret at an early age, then speech and graphics have some point of commonality.

Question 4

Are the apprentices, whose performance on the LAB is in the lowest quartile, able to make adequate progress through their apprenticeship training program?

Although attempts had been made in the training modules to compensate for apprentices' low literacy levels by providing audio-based and audio-visual materials, the lowest quartile of apprentices, selected both on the LAB total raw scores, and on VORELATE reading scores, were not making adequate progress. They were not able to utilize their positive reading potential successfully to ensure adequate progress. In Gutherie's terms, they were not in a state of literacy equilibrium (Guthrie, 1983).

It can therefore be concluded from the study that VORELATE can be adequately used for the identification of at risk apprentices. Those apprentices scoring in the lowest quartile on the Prose and Graphics subtests were higly at risk.

The results also suggested that apprentices in the lowest quartile possessed vocabulary skills which were not greatly diminished in comparison to students in the other quartiles. Although the at risk apprentices had relatively high vocabulary ability and high reading potential, they were not able to make the minimum prescribed progress, even with the aid of a variety of audiovisual materials, plus the assistance of special vocabulary lists and glossaries of terms. Even though these strategies capitalized on the apprentices' strengths (higher vocabulary ability and listening ability), they remained at risk.

Recommendations

The following suggestions for further research arise from the results of the present study.

1. The focus of this study has been on apprentices with low literacy skills. Detailed analyses should also be conducted in relation to the skills requirements of the learning tasks in various training modules in the

print, audio and audio-visual and computer formats. An aptitude treatment interaction study based on the Developmental Literacy Model could result in new patterns and implications for re-designing instructional modules and for directing apprentices to various kinds of training packages.

2. Further study of individual automotive mechanic apprentices performing in the lowest quartile is warranted, in order to identify possible anomalies related to their level of skills and rate of progress through their training modules. For example: Why do some apprentices with adequate literacy skills fail to make satisfactory progress and some with apparently inadequate literacy skills manage to progress at an adequate rate?

3. Do apprentices with high reading potential make significantly better progress on audio-visually based learning modules than on print alone modules? Are such scores in fact useful in selecting those apprentices who should be able to improve their reading comprehension levels to the identified levels of listening comprehension? In short, is the concept of reading potential useful and can apprentices be assited to achieve such potential?

4. This study demonstrated that the poorest readers benefit more from illustrations, tables, charts, figures and graphs than good readers because the graphics in the Graphics subtest were able to compensate for any prose reading comprehension deficiencies. It is strongly recommended, therefore, that graphic literacy be explored as a means of both improving apprentices' job literacy skills and of improving their learning performance in vocational education courses. Apart from clarifying how graphics materials assist comprehension, further studies could also indicate whether improvement in this area is transferable to improvement in prose comprehension.

5. Do speech and graphic displays have points of commonality which enable each to facilitate comprehension? The Developmental Model provides answers for this question in relation to speech but not in relation to graphics.

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Regional colleges : Resource sharing between vocational education and higher education

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Abstract

Regional colleges of TAFE in the numerous, relatively small non-metropolitan centres in Australia constitute an opportune circumstance for developing a modest but significant sharing of resources between vocational and higher education. This paper describes Murdoch University's experience in contracting with regional colleges to provide tutorials for supporting distance education study, and general study centre services. Contracting helps to overcome the constraints of small classes, because the teaching load that is required to justify a new staff position is more readily attained if vocational and higher education teaching loads are summed. Further sharing of resources occurs with library, computing, student counselling and other services. Key points in the organisation of this form of TAFE-higher education interfacing are outlined, and related to Federal and State Government policies for promoting post secondary education in regional communities. The name "Distance Education Agency" is proposed for regional college services to providers of distance education.

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Regional colleges : Resource sharing between vocational education and higher education

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Introduction

Vocational education in Australia has very few direct links to higher education. The technical and further education sector (TAFE) is managed and funded by State governments, whilst the higher education sector at universities and colleges of advanced education is managed and funded by the Federal government, notwithstanding the States' constitutional responsibility for all sectors of education.

The lack of direct collaboration between vocational and higher education has not been a topic of interest in the capital cities and some other, larger population centres, because the cities can support a good number of different types of tertiary educational institutions. However, Australia has a significant number of smaller, mostly isolated population centres in which the sharing of resources between vocational and higher education could be an important benefit to the communities involved, because they are relatively deprived for tertiary education (Hudson, 1986).

The smaller population centres that are the subject of this paper are typically 10000 to 25000 people, which is large enough to support a "regional college of TAFE" for vocational education, but not large enough to support a higher education campus. From the perspective of the people living in or near these centres there are obvious advantages in having vocational and higher education resources shared within their own regional college. A multi purpose college can be larger, offering a wider range of courses for both sectors of tertiary education, and thus improving educational opportunities within the region. The regional economy can benefit from the employment of additional staff and construction of additional facilities at the regional college instead of expansion in the capital city.

However, the devolution of higher education activities into regional colleges of TAFE has been a slow process, limited by institutional and governmental policies and practices. Workable methods have to be found to enable an effective sharing of resources between TAFE and higher education. This paper outlines recent changes in policies and practices, which have improved the scope for multi purpose regional colleges, and proposes that "Distance Education Agencies" should be the principal method for operating an effective collaboration between TAFE and higher education in regional colleges.

Government policies for higher education in regional colleges

Consistent with earlier encouragement for the role of regional colleges of TAFE in higher education (Atkinson, 1987), recent guidelines from the Federal government address the principle issue explicitly. Under the heading "Using the TAFE network for the provision of higher education", the White Paper (1988, p65) stated :

> ... as one means of expanding opportunities for higher education study, more co-operative arrangements should be developed to allow the use of local TAFE facilities in courses offered by higher education institutions. These arrangements already apply in various parts of Australia, and have particular application in non-metropolitan localities too small to justify a separate higher education institution.

Particular options canvassed in the White Paper included "teaching of the early years of higher education courses under contract by TAFE using its own staff", and "the use of TAFE library and related facilities by external higher education students, supplemented if appropriate by a tutorial service organised by their home institution or by TAFE". Although no specific models were cited, the Federal government outlined a further option with reference to regional areas too small to sustain separate TAFE and higher education facilities :

> It sees considerable merit in developing further the institute of tertiary education concept, which provides for an appropriate mix of local higher education and TAFE courses in a single institution with considerable autonomy to meet the tertiary education needs of the community (The White Paper, 1988, p65).

Although the regional colleges of TAFE are not permitted to offer their own higher education courses (White Paper, 1988, p65), the renewed endorsement of their role should promote a re-examination of their relationships with higher education providers. The foremost influence on this relationship will be the extensive reorganisation of higher education external studies into a nationwide system of "about six" Distance Education Centres (DECs) announced in the White Paper.

The sharp contraction from about 48 providers of higher education external studies in Australia to about six institutions, or amalgamated institutions, having a DEC will result in renewed interest in regional colleges as collaborators. Firstly, the new DECs will seek to develop their infrastructure arrangements, including study centres at regional colleges, on a larger scale than previously possible. Secondly, the new DECs will be in a pre-eminent position to engage regional colleges in contracts to teach higher education courses, having at their disposal high quality study materials to assist the local lecturers and students.

A further influence on regional college collaboration with higher education providers will be the policies adopted by State governments, which are the controlling authorities for the TAFE sector. As the State governments formulate their responses to the Federal government's White Paper (1988), the present time may be particularly opportune for the proponents of regional college expansion to be presenting their views vigorously to their State authorities.

Regional colleges and Distance Education Centres

As outlined above, there are two main areas for the interaction between regional colleges and DECs, study centre services and contract teaching. In assessing these, it is important to note some Federal government expectations about this role for external students :

> Provider institutions should improve the quality and range of support services, with particular emphasis on using the extensive TAFE infrastructure for all external students. The Government is interested also in support services that could promote greater participation of young people, particularly where external studies is undertaken as part of a mixed mode course (Dawkins, 1987, p38).

This indicates a link between the two areas of interaction. If full time school leaver students enter higher education through a regional college, improved support services and "mixed mode" study should be available. "Mixed mode" may be an appropriate combination of local teaching for some units or subjects, and conventional external study for others. This method, linked to study centre services, has been adopted for Murdoch University contracting with regional colleges in Western Australia, as described below and by Atkinson (1987).

With distance education enrolments, regional college services may be varied in a flexible way to take into account factors such as size of the local group, readiness of students for autonomous study, inability of some students to attend regularly owing to other commitments or distance, quality of the distance education package, availability of college staff qualified in the subject area, etc. Thus, for an individual student, college services may include conventional classroom teaching, often assisted by a distance education package; or a weekly tutorial to support the study of a distance education unit; or in other units the services may be modest study centre functions including occasional informal academic assistance.

The advantages to regional colleges of undertaking higher education work through DECs are associated with resource sharing, and increased size and status as the accredited regional agent for metropolitan institutions. The teaching load that is required to justify a new staff position is more readily attained if vocational and higher education teaching loads can be summed. Whilst a summation of teaching loads could not be used for fields of study that are not represented in both vocational and higher education, for example hospitality and the building trades, it is a relevant concept for important fields such as commerce and nursing, and individual subject areas such as English, mathematics and computing. Diversification into higher education teaching, although likely to be limited to first year level, improves the attractiveness of regional college teaching appointments. In addition to benefits for staffing, resource sharing with higher education can extend to other areas such as library, computing laboratories, science laboratories, counselling services and student facilities.

For Distance Education Centres, there are two important classes of benefit from association with regional colleges. Firstly, DECs may expect improved recruitment of students through a regional agent which has good contacts with the community, particularly with school leavers who wish to commence higher education without having to leave their home town, and with persons who have found that the study of appropriate vocational education courses opens a pathway into higher education. Also, the regional colleges may improve enrolments by persons who because of lack of confidence would not commence external study, unless "bridged" into this mode by a transitional phase consisting of local tuition for selected first year units with an experienced tutor-counsellor. Secondly, DECs may expect improved retention of students if supported by high quality local services, especially for inexperienced students in their first year of study. Local services from the college can include tuition for selected first year units, and general study centre services as discussed below.In order to examine potential disadvantages and difficulties with regional colleges engaging in higher education work, the next section provides a brief review of Western Australian experiences. These experiences are especially relevant because higher education campuses in WA are all located in Perth, except for several small branch campuses, and therefore the contrast between city and country is more marked than is the case in the major eastern states.

Western Australian higher education links with regional colleges

"Regional college contracting" has become well established in Western Australia, through work by Walsh (Walsh, 1986), the Western Australian Post Secondary Education Commission (WAPSEC), and individual colleges. The major activity has been contracts for conventional classroom delivery of the first year of an award from Curtin University or the Western Australian College of Advanced Education (WACAE). The number of lecture, tutorial and practical class hours for each unit of study is usually the same as the metropolitan campus timetable, with little or no use of distance education packages. More recently, Murdoch University External Studies has developed contracts that are based upon distance education enrolments, with college staff conducting weekly tutorials for selected first year units, to supplement the distance education study, together with modest study centre services for later year students (Atkinson, 1987).

The colleges involved are Great Southern Regional College of TAFE (Albany), Geraldton Regional College of TAFE, Kalgoorlie College, Karratha College and Hedland College (Port Hedland). The last three named are autonomous colleges, governed by their own councils, but in practice there is little distinction between the roles of each and the contractual relationships with the Perth based campuses of the higher education providers. Also, the largest of the regional centres, Bunbury, has the South West Regional College of TAFE and the Bunbury Institute of Advanced Education, a small branch campus of the WACAE. None of the regional centres is large enough to support a full range of vocational education courses, and it is important to note that Western Australia's provider of vocational education in the distance education mode, TAFE External Studies (TES), is increasing progressively its contracts with regional colleges. These contracts are similar to the Murdoch University External Studies contracts, but in addition, TES sells distance education packages for various colleges to use as a basis for teaching their own awards.

The wide range of problems encountered in WA regional college contracting, and the solutions obtained or being evolved, may provide useful guidelines for other Australian states. Although a full discussion is beyond the scope of this paper, a brief listing of problem areas could include the following:

- whether to concentrate regional higher education resources within a single multi purpose college, or diversify through branch campuses (for example, some observers argue that the Bunbury branch campus of the WACAE is too small for viability, that there is uneconomic duplication of resources, and that the branch campus should be integrated with the physically adjacent South West Regional College of TAFE; other observers argue that the branch campus model should be extended to other centres).
- methods for teaching small classes. Regional college higher education classes rarely exceed 15 students, and are usually much smaller. In practice it is likely that a range of complementary methods will coexist, including conventional classroom delivery for first year units in high demand areas such as commerce and

nursing, distance education with local tutorial for other classes, and conventional distance education with a remote tutor in Perth for more specialised and later year units.

* where distance education methods are used to overcome the barrier of small class sizes, what particular set of methods should be used? Should more importance be placed upon local staff conducting face to face tutorials, or upon live lectures delivered from metropolitan campuses by satellite and landline television?

* what level of resources should be devoted to regional college study centre functions? Considerable research and extensive debate on student support services for distance education have occurred in recent years, for example the major studies by Castro, Livingston and Northcott (1985); Gough (1980); Northcott and Shapcott (1986); and Dekkers, Kelly and Sharma (1988). However, no agreed standards have emerged and in the WA context, with small and widely dispersed regional populations, it seems clear that cost effective study centre functions will be confined to a modest level, with maximum possible sharing of resources between higher and vocational distance education.

* regional colleges in WA are presently undertaking work for up to four providers, Curtin University, WACAE and Murdoch University for higher education, and TES for vocational distance education. Whilst this may seem to be an excessive number of providers, in practice there is little duplication of awards or individual units of study. Indeed it may be an advantage to have a diverse range of institutional providers, to enable individual colleges to have some influence in selecting, for each award that is amenable for some form of local tuition, the provider that best meets the local needs and circumstances.

* the availability of contracts or intake "quotas" for teaching the first year of some awards in regional colleges. For example, contracting the first year of primary teacher education, which is subject to statewide admission quotas, is difficult to implement if the provider faculty is fully staffed and cannot afford to "lose" student numbers to regional colleges, even if it is only a small proportion of the first year student count. Ideally, intakes into awards that are limited by quotas should be determined by the academic merits of the applicants, without regard to the proposed mode of study. It may be easier to develop this ideal for distance education based study, because of the greater reliance on part time, off campus tutors usually associated with this mode.

* formulas for payments from the provider institutions to regional colleges for teaching and study centre services have not been standardised. It is likely that the various formulas will become more closely linked to counts of equivalent full time student units (EFTSUs) in accordance with Federal government procedures for funding higher education. However, there may be advantages in continuing the present flexible, market oriented approach through individualised formulas renegotiated annually. Although it is clear from recent policy statements (the White Paper, 1988) that the Federal government expects to have regional college higher education activities funded out of the provider institution's normal recurrent funding per EFTSU, there is room within this limit for considerable further experimentation to find the most mutually acceptable financial arrangements.

* other problem areas include administrative and operational problems causing delays in obtaining class lists for the colleges; in some cases the higher education provider may not be fully satisfied with the qualifications possessed by TAFE staff; problems in ensuring that college staff are fully briefed on the teaching to be conducted, although this problem is less significant when distance education packages are used; some fields of study such as nursing can incur high startup costs and the college does not usually have the required equipment resources; differences between staff employment conditions for higher education and TAFE may be a future problem; etc.

It is evident from the above that much further work has to be done to establish recognition and understanding across divisions between TAFE and higher education, divisions between distance education methods and traditional classroom methods, and divisions between the various participants. Nevertheless, collaboration between regional colleges and higher education in WA is firmly established and refinements and innovations continue to emerge.

Distance Education Agencies

The formal title "Distance Education Agency" is proposed here to highlight the growing importance of links between regional colleges of TAFE and tertiary distance education. Conceptually, a distance education agency is a function within and controlled by a regional college, with responsibility for negotiating with one or more DECs and other providers of tertiary study awards, to obtain contracts for teaching local tutorial groups in appropriate courses or units, and providing general study centre services. The overall justification for the agency function is that it is to provide an efficient and effective procedure for sharing resources between TAFE and higher education in regional colleges. The agency concept assumes that the regional populations are too small to warrant the conduct of operations by a single DEC, or the establishment of a branch campus. Certainly this is the case in most, if not all, of the WA non metropolitan regions. In any event, there are advantages in the concept of a college controlled function, to encourage local initiatives, and give maximal scope for sharing of resources between a variety of providers of awards. As an example of local initiative, Albany's Great Southern Regional College conducts an External Studies Agency, with some Federal government funding. An integrated service for both higher education and TAFE sectors of distance education, it has developed to a level that warrants 1.5 equivalent full time staff for coordination, counselling and secretarial functions (Davy, 1988).

The concept does not require the appointment of staff specifically for an agency at a regional college, as the functions may be assessed in terms of equivalent full time staff. However, earnings by the larger regional colleges should be sufficient to warrant the nomination of one member of college staff as a full time coordinator and counsellor, with limited teaching duties, provided that the college integrates agency activities across all sectors of distance education.

Whilst the appointment by colleges of specialist coordinator-counsellors with distance education expertise is obviously a desirable asset for an agency, the concept is likely to function more effectively if the allocation of agency income is determined by each college in accordance with local priorities. For example, in some circumstances the appointment of additional teaching staff in an expanding subject such as computer science may be the most immediately effective measure for securing further and larger contracts. In other circumstances, some other allocation may be more effective in terms of expanding the agency's contracts.

The specification of a distance education agency as a "college controlled function" implies the encouragement of a "market" relationship between DECs and agencies. In this "market", DECs and providers of vocational distance education may offer payments, from their normal recurrent funding, to colleges for the performance of specified functions, whilst the colleges' agencies may choose contracts with one or several providers, according to the services they can afford to provide at the offered level of payment. This is not an argument in favour of "marketing" as a general principle in education, but a mechanism for permitting widespread, operational experimentation with college based tutors instead of remote, metropolitan based tutors, and with different mixes and levels of study centre services, and other questions important for the relationship between regional higher education and distance education.

The accordance of a high degree of regional autonomy to a college's distance education agency is a key feature in the concept. Whilst the metropolitan higher education providers no doubt would prefer to exert centralised control and exclusivity, the alternative kinds of controls exercised by a market for services, and by the continuing professional development of the operational staff, may be more conducive to innovation and responsiveness to the needs of the regional communities.

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STUDENT WITHDRAWAL FROM PART-TIME COURSES OF FURTHER EDUCATION

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INTRODUCTION

Student withdrawal, or dropout, before completion from courses of part-time study in post-compulsory education is globally about one-third of those enrolling. The situation at Bedford College of Higher Education, a large college providing a wide variety of further and adult education, is no exception. Since low retention rates represent a waste of resources and a loss of opportunity for students (Audit Commission, 1985) the college has recently collected both qualitative and quantitative data about factors which contribute to student dropout, in order to inform future course management and provision.

RESEARCH STRATEGY

Aware of the limitations of postal questionnaires as the sole data in dropout research (Parkinson et al., 1987; Savicki et al., 1970) this study chose to interview recent dropout students and to adopt an illuminative model of educational enquiry (Parlett and Hamilton, 1972).

The research design comprised:
preparatory work - familiarisation with the context, talking to teachers, students; pilot interviews and questionnaires, a literature review, definition of dropout;
selection of the foci of the study - information from student registers;
interviews with dropout students (N = 34),
postal questionnaires to dropout students (1986/87, responses N = 148),
postal questionnaires to dropout (1987/88 N = 125) and persister students (1987/88 N = 175),
analysis and interpretation of data.

It is important to clearly define dropout (Savicki, V.G. et al., 1970). Three stages of dropout were identified: early withdrawal - the student was in attendance three weeks after the September start of the course, but absent on 1 November and thereafter; mid-session withdrawal - in attendance until the second week of the second term, but absent thereafter; and late withdrawal - in attendance up until the final six weeks of the course, but absent thereafter.

Following the preparatory work a total of 1206 students from 116 classes were contacted and the 482 responses received (40%) were analysed. Analysis of the interviews of the dropout student led to the following issues being followed through by questionnaire: reasons for enrolling, course and classroom experience, advice, the college environment, aspects of employment, practical/domestic factors, aspects of travelling, aspects of study problems. A survey of class attendance registers for the wide range of college pre-degree course provision identified dropout to be most pronounced from courses taken by part-time students of general education classes in English, humanities, mathematics, sciences and secretarial studies. In general, courses involving employer sponsorship or day-release from work, eg in building studies, engineering, catering, hairdressing, technician science, had a much lower dropout rate. The former courses, therefore, became the focus for the study.

FINDINGS

Many factors contribute to a student's decision to withdraw and the relationship between them are complex. These may conveniently be grouped as: course or institutionally related factors which are potentially within a college's control; and non-course, non institutionally related factors which are determined by a student's personal circumstances. Course related factors include: classroom experience, advice and guidance opportunities, college environment and facilities. Non-course related factors include: employment factors, personal characteristics, domestic circumstances.

Course Related Factors

Enrolment experience:

> "I really would have liked some more information ... when I enrolled onto the course there wasn't anybody to talk about it."
> "I would have liked my teacher to be there, but there wasn't anybody there, just people taking details."

The most frequently stated reasons for enrolment were to satisfy a personal interest (86/87, 51%; 87/88, 54%), to improve job prospects (86/87, 48%; 87/88, 42%), and to improve existing skills for work. Although almost half of the students said they were not informed about what their course entailed before they enrolled, many (86/87, 64%; 87/88, 74%) stated that had they received more information this would not have affected their decision to withdraw. Most students had not seen their (future) teacher at enrolment, but nearly two-thirds said it is important to do so. Students would like more guidance about what to expect from their course.

Classroom experience:

> "The teacher just stood in front of the blackboard and dictated the lesson, leaving no time to discuss the work that had been studied."
> "After talking to many people who attended either of my courses they did agree that it was very difficult as the pace was too fast ... there was a constant pressure from the teacher that we were running behind schedule."

Although the majority of dropout students indicated that in general their course experience was satisfactory, about one-third, and rather more in the case of interviewees responded negatively to some aspects of their classroom experience (Glynne and Jones, 1967). Their negative experience related to their perceptions about teaching methods, insufficient time spent discussing academic problems, an unsuitable pace of teaching and lack of fulfilment of their prior expectations. The most common observation was that the pace of teaching was too fast and, according to interviewees determined by the teacher and students with previous knowledge.

Advice, guidance and academic counselling:

> **"As soon as nine o'clock came everyone wanted to rush off home including the teacher ... there wasn't enough time to discuss anything."**
> **"I feel part-time students don't excel because they do not have the same class unity experience and support like full-time students."**

Many interviewees and questionnaire respondents (47%) stated that there was not enough time to discuss problems related to their study. More than one-third (38%) needed to talk to someone about academic problems. Access to formal and informal advice and guidance appears to be limited.

College environment and facilities:

Although over half of the students (63%) 'felt part of their class', almost half found the college impersonal. Whilst many were aware of library (70%) and refectory facilities (61%) very few were aware of college counselling (14%) or sports facilities (28%).

Non Course Related Factors

Employment factors:

> **"I think I was in very favourable circumstances for evening study, I didn't have any social or financial problems and few responsibilities ... I still found it difficult to do private study... I was working in manual work and the simple physical fatigue made concentration difficult."**

For many students (about44%) some aspect of combining part-time study and full-time employment posed serious difficulties, though in interviews these issues did not emerge as strongly as course-related factors.

Study related problems:

> "I found coming back to study hard with all the work and the quantity of reading involved ... it felt like other people had done it before ... I think I panicked and didn't feel as though I could catch up."

Students (86/87, 35%: 87/88, 42%) also indicated that study problems associated with techniques required for successful study affected their decision to withdraw. The majority of respondents had not undertaken any previous related study.

Personal characteristics and domestic circumstances:

About one-third of respondents indicated that practical or domestic reasons such as ill-health and family commitments had contributed to their decision to withdraw. Interviewee responses indicated that decisions to withdraw were not generally influenced by personal or domestic circumstances and in cases where this was so, other factors such as dissatisfaction with classroom experience were stated too.

STUDENTS WHO PERSIST

Responses from students who had not withdrawn provide interesting comparative data. Persisters give significantly more favourable responses about their college experience. Parkinson et al, (1987) reported similar findings. (Table)

Table: Responses from dropout and persister students about their course experience

Descriptor of student experience	% of students responding 'yes'		
	Dropouts		Persisters
	1986/7	1987/8	1987/8
teacher easy to get on with	78	84	90
teacher was encouraging	68	70	90
course content interesting	63	66	91
teaching methods appropriate	61	66	90
course experience satisfactory	54	65	93
course content as expected	49	49	69
time in class to discuss problems	44	38	72
course taught at a suitable pace	45	47	81
on the wrong level of course	22	26	10
course content too difficult	24	19	7

FROM RESEARCH TO ACTION

If the college addresses the internal course related factors then students may overcome some of their personal circumstances which otherwise make their sustained study problematic. On the basis of this research, an action plan is now being developed with a view to reducing the part-time student dropout. Attention to the following features arising from the research are anticipated:

- more systematic pre-enrolment and enrolment guidance and counselling
- assessment of the students' relevant prior learning and appropriate study mode
- identification of employment, domestic and study demands
- induction to the college, its facilities and teachers

- developing, where possible and appropriate, employers awareness and support for their employee's wish to learn
- monitoring students' perceptions of their classroom experience, including the pace of learning
- enabling time for class discussion
- identifying and counselling intending withdrawal

The involvement and development of college staff will, of course, be essential.

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Quotations are perceptions of students who withdrew.

NOTES

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IMPROVING THE QUALITY OF VOCATIONAL EDUCATION

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Vocational education at the higher secondary stage in India is comparatively of recent origin. For the first time at +2 stage it was introduced in 1976. It got the momentum with the implementation of the National Policy on Education, 1986. National Policy on Education made distinct recommendations regarding the introduction of vocational education in the country. The policy gave it a distinct status of a stream, intended to prepare students for identified occupations spanning several areas of activities. It was also proposed that vocational courses should cover 10 percent of higher secondary students by 1990 and 25 percent by 1995.

Bringing 25 percent of students under the umbrella of vocational education is not an easy task. The enrolment mostly will depend on the quality of the vocational education which the institutions will impart in the first few years. In case, students completing these courses are able to get suitable jobs, enrolment automatically will rise. Therefore, this is the opportune time to put our best for improving the quality of vocational education.

The intake in vocational courses in the country in 1987 was just 72,000 which worked out to be 2.5 percent of those entering the +2 stage in schools. This indicates that the enrolment during the year 1987 was not upto our expectations. Besides, thequality of vocational education has also not been the same as envisaged in the policy due to lack of equipments and facilities in the schools, funds, linkage with employers non-availability of competent teachers, on-the-job training facilities and text books. The slow growth is also due to problems relating to placement, community resources, curriculum revision and proper organisation and administration.

Vocational educators are responsible for preparing students for job-entry competencies as well as for those responsible for advancement in the career. This requires mastering of content, development of attitude and skills necessary for career objectives. These will influence the teaching strategies to be used by vocational educators. Vocational educators should be able to provide an environment suitable for each learner. The teaching strategies necessary for vocational education can be discussed under two heads:

Strategies for the class-room:

Vocational educators while planning the classroom activities should consider the national objective on the one hand and should consider the career objectives relating to cognitive, affective and psycho-motor domain on the other hand. They should also understand the fact that learning is always an individual process. No matter which instructional method, media or strategies are used, each student must learn from class room experiences.

Looking to the different varieties of objectives and the needs of students the vocational educator must use varied methods and media in the classroom. Apart to the traditional methods which are important, the teacher should use demonstration, discussion, case, role playing and simulations in the class-room instructions. The latest equipments and other devices like slides, film-strips overhead projector, tape recorder and TV are also to be used for improving the quality of vocational education. While using different methods of instruction, the teacher must understand that no single teaching method is equally effective for all students and for accomplishing the different objectives i.e.cognitive, affective and psycho-motor.

Physical facilities play an important role in improving the quality of vocational education. In most of the developing countries schools have poor physical facilities. The school administration must provide the required facilities needed for developing vocational competencies. Depending upon the availability of equipment and the need of the course different organisational plans viz. rotation, battery or model office may be used.

Strategies for on-the-job training:

The latest methods and techniques may enhance learning in the classroom but can never take the place of on-the-job training. All vocational instructions can be divided into two categories. The general instructions consist of common competencies that all students need in order to succeed in any job. Examples include units on human relations, communications, work values and basic skills. Specialized instruction consists of uncommon competencies individual students need for their specific jobs. Examples are instructions on office equipments, molding and contructing. These skills are taught through individualized instructions and/ or small group instructions depending upon number of students for similar job.

The mastery level skills in the specialized areas can best be developed by on-the-job training. Organising a programme of on the job training is a serious task.

The teacher coordinator (incharge of the programme) must have successful relationships with business and industrial community. Teacher coordinator must have credibility with all types of employers, with students and with school administration.

For quality training, the selection of appropriate organisation is extremely important. The teacher coordinator must discuss and negotiate the competencies the students are expected to achieve with the organisation during the training period. A training plan may be developed which may describe the procedures and responsibilities of all the concerned parties. A proper system of supervision and evaluation may be chalked out by the teacher coordinator and the supervisor from the industrial organisation. The trainee may rotate on different jobs thereby, developing essential competencies and skills to perform the job successfully. The entire training programme may also be evaluated for the purpose of improving the same for future.

For getting necessary cooperation from business and industry a Vocational Education advisory committee may be constitued in the school. This advisory committee may prove to be very effective for challenging tasks like developing community relationships, selecting suitable organisations for the placement of students and for helping students in getting jobs after completion of on-the-job training. An active advisory committee may also help the school in updating the curriculum, physical facilities and evaluation tools necessary for improving the vocational education programme. The follow-up studies asking the students about the strengths, weaknesses and recommendations for the improvement of the programme may also be assisted by the Advisory Committee.

Summary

Vocational education is the thrust area of National Policy on Education, 1986. For producing competent work force, it is essential to improve the quality of vocational education. For this purpose it is essential to strengthen the classroom activities and on-the-job training. In the class the teacher should use all the latest methods, techniques and media for enhancing the learning of the students. On-the-job training is essential for the competencies related to the specific jobs. The teacher coordinator must have successful relationship with the business and industrial community. For quality training proper placement of students is essential. Students must be observed and evaluated by the teacher coordinator and the supervisor on the work place. The vocational advisory committee will prove to be effective in developing community relationships, selecting organisations for training and helping in getting jobs after training. The committee may also help in updating curriculum, physical facilities and evaluation tools.